MEDICAL LIBRARY

DEC 6 1947

VOLUME 46 NUMBER 5

ARCHIVES OF

OTOLARYNGOLOGY

EDITORIAL BOARD

GEORGE M. COATES, Chief Editor
1721 Pine Street, Philadelphia 3

WESTLEY M. HUNT, New York
RALPH A. FENTON, Portland, Ore.
ERNEST M. SEYDELL, Wichita, Kan.
CHEVALIER JACKSON, Philadelphia
ROBERT L. GOODALE, Boston
J. MACKENZIE BROWN, Los Angeles
CARL H. McCASKEY, Indianapolis

NOVEMBER 1947

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH DEARBORN STREET, CHICAGO 10, ILLINOIS. ANNUAL SUBSCRIPTION, $6.00

Entered as Second Class Matter Jan. 14, 1925, at the Postoffice at Chicago, Under the Act of Congress of March 3, 1879

COPYRIGHT, 1947, BY THE AMERICAN MEDICAL ASSOCIATION

CONTENTS OF PREVIOUS NUMBER

OCTOBER 1947. NUMBER 4

Bell's Palsy: Pathology and Surgery; a Report Concerning Fifty Patients Operated on After the Method of Ballance and Duel. Karsten Kettel, M.D., Hillerød, Denmark.

Osteomyelitis of the Basisphenoid and Basiocciput with Meningitis and Cranial Nerve Palsies as a Complication of Nasopharyngeal Packing for Control of Epistaxis: Report of a Case with Recovery. Arthur A. Spar, M.D., and Henry L. Williams, M.D., Rochester, Minn.

Symposium on Fenestration of the Labyrinth:

Lempert Fenestra Nov-Ovalis Operation for the Restoration of Serviceable Unaided Hearing in Patients with Clinical Otosclerosis: Its Present Evolutionary Status. Julius Lempert, M.D., New York.

Osteogenesis Following Fenestration of the Vestibular Labyrinth of the Rhesus Monkey: A Controlled Experimental Study. Julius Lempert, M.D., New York; Philip E. Meltzer, M.D., Boston; LeRoy A. Schall, M.D., Boston, and Dorothy Wolff, Ph.D., New York.

Revision of the Fenestration Operation. Philip E. Meltzer, M.D., Boston.

Medical and Surgical Care of the Patient Selected for Fenestration of the Labyrinth. K. M. Day, M.D., Pittsburgh.

Training of Surgeon and Selection of Patient for the Fenestration Operation. J. H. Maxwell, M.D., Ann Arbor, Mich.

General Correlation. Marvin F. Jones, M.D., New York.

Case Reports:

Successful Auricular Autotransplantation. Alfred Wachsberger, M.D., Sacramento, Calif.

Abstracts from Current Literature.

Society Transactions:
American Laryngological Association.

Book Reviews.

News and Comment.

Directory of Otolaryngologic Societies.

ARCHIVES OF OTOLARYNGOLOGY

VOLUME 46 NOVEMBER 1947 NUMBER 5

COPYRIGHT, 1947, BY THE AMERICAN MEDICAL ASSOCIATION

TONSILLECTOMY AND POLIOMYELITIS

DANIEL S. CUNNING, M.D.
NEW YORK

AT THE MAY 1946 meeting of the American Laryngological, Rhinological and Otological Society, Inc. I presented a brief review of the literature regarding the relationship of tonsillectomy and poliomyelitis.

The purpose of that survey was to determine the soundness of discontinuing the performance of tonsillectomies during the months of poliomyelitis outbreaks.

It was my conclusion at that time that on the basis of reported evidence in the literature there had not been established a direct causal relationship.

Such a conclusion was obvious from a critical study of the facts. Primarily, from the standpoints of etiology and epidemiology the disease has remained obscure despite the tremendous amount of scientific effort still being exerted in these respects The causal agent is known—a virus, a total parasite with a specific affinity for neural tissue. Its habitat in nature has not been discovered, despite organized and intensive research. On occasions flies have harbored the virus, but its presence there has been of a transitory nature. Research of this phase of transmission incriminates the fly as a rare, mechanical transporter of the virus. No evidence has been uncovered that would suggest the fly as a focus of multiplication of the virus or incriminate it as a frequent link in the chain of transmission to man.

Similarly, the virus of poliomyelitis has been recovered on occasions from sewage during epidemics and in epidemic areas. This is to be expected from the previous evidence that the intestinal discharges of patients or carriers contain large amounts of the virus of poliomyelitis. No multiplication of virus occurs in sewage, and the virus is viable in that medium for only a matter of hours. Furthermore, the characteristics of the disease do not resemble those of a water-borne epidemic.

Recently, strong evidence has accumulated to strengthen the belief that during epidemics the virus may be widespread. The latest study

From the Manhattan Eye, Ear and Throat Hospital.

Read before the American Laryngological, Rhinological and Otological Society, Inc., St. Louis, April 26, 1947.

presents evidence which points out the possibility that for every reported patient with recognizable symptoms of poliomyelitis there may be as many as 600 persons without reportable symptoms yet fully capable of spreading infection. With large amounts of virus excreted from the bowels and smaller amounts from the throat, it would appear almost impossible to avoid coming in contact with the virus during an epidemic. It is the opinion of the majority of authorities on poliomyelitis that the disease occurs as a result of an intimate contact between a susceptible person and one harboring the virus.

But what constitutes susceptibility? There again recognized authorities are forced to theorize in the face of a lack of scientific evidence. If, according to recent belief, there are for every reported patient with clinical symptoms 600 persons harboring the virus and actually infected, yet without symptoms, what factors constitute the resistance of these 600 to clinical infection with symptoms? The possibilities are myriad: among them are immunity developed through previous repeated mild exposures, dietary and constitutional makeup, and an equilibrium established between the virus and the host. The next question is: What possible factors may account for the lack of resistance or the changing of a carrier state into the clinical syndrome?

According to present beliefs, the "trigger" may be one of many things: overfatigue, sudden change of body temperature, overexposure to sunlight or tonsillectomy. Some scientific evidence has been presented to support each belief, without, however, conclusive proof of the reliability of any one of them. The pros and cons of research investigators implicating tonsillectomy as a causal factor in poliomyelitis were thoroughly presented by me in the review already mentioned. It is unnecessary to repeat them at this time.

It was suggested at the aforementioned May meeting that a nationwide survey be carried out by the members of the American Laryngological, Rhinological and Otological Society. It was proposed that each section chairman appoint one or more members from each state to gather pertinent information for a statistical report to be returned to the society at the next meeting.

This proposal was adopted and carried out, and I am prepared at this time to report the results of the survey.

Although the relationship of tonsillectomy and poliomyelitis is of vital concern to every member of this group, not many of the members cooperated in making the survey. Some members made no report; others made reports that were so sketchy and incomplete as to be useless, and many failed to return the questionnaires, sending in a summary of their interpretations, which, for reasons of scientific accuracy, could not be used.

Of 6,000 questionnaires received, almost 4,000 had to be discarded. A large number of the questionnaires stated that the case history was incomplete; so whether or not a tonsillectomy had been performed was unknown. Such cases had to be discarded. Only from thirteen states were reports received that proved accurate and valuable. As a result, although during 1946 there were 25,204 cases of poliomyelitis in the nation, I received pertinent information on only 2,476 cases. Statistics from such a small sampling do not warrant the drawing of any definite conclusions from the study. Because of the lack of cooperation of some members of the group, the sincere efforts of many others have been made worthless.

Although this study cannot have the desired effect of settling conclusively the problem whether surgeons should avoid removing tonsils during epidemics of poliomyelitis, certain valuable evidence has resulted, which will be presented.

Questionnaires have been tabulated for thirteen states—New York, New Jersey, Delaware, Oregon, New Hampshire, Ohio, South Dakota, South Carolina, Arkansas, Maryland, Illinois, Idaho and Massachusetts. Only cases which occurred in 1946 were included in this study. It is extremely regrettable that returns were not obtained, or were obtained too late, from "heavy epidemic states," such as California and Minnesota. I do not wish to appear too censorious in my criticisms of lack of cooperation. I realize fully that the information requested was exceedingly difficult to obtain and that in many instances in which information was not received the fault was not with the individual members attempting to secure the data.

Certain standards were set up for the tabulation of the data. Operations that occurred up to two months preceding the onset of poliomyelitis were included. When cases were grouped as "paralytic" or "nonparalytic," the "paralytic group" was reclassified as cases of spinal involvement, the "nonparalytic group" as cases of mild involvement, the "bulbar paralytic group" as cases of bulbar-spinal involvement. When the type of involvement was not stated or was referred to as "mild" but the patient was reported to have residual paralysis, the case was classified as one of spinal involvement.

The failure of the present report to settle definitely the causal relationship of tonsillectomy and poliomyelitis is regrettable but not at all final. A satisfactory answer can be obtained and must be had. It is evident that the method used in this survey is complicated and the information so difficult to secure as to make success almost impossible. But—I believe this survey can be carried on by the men in the different localities when they see just exactly what information must be obtained. In addition to this it should be possible to compare the incidence of poliomyelitis occurring in a group of tonsillectomized children with the

incidence of poliomyelitis occurring in the general child population. The result of such a comparison would be significant.

I propose that a study be made of several thousand children who will be tonsillectomized during the months of June, July, August and September. A number of hospitals should be selected, located in different parts of the country so that local epidemiologic characteristics may be properly balanced. Fifteen or twenty institutions should give the required number of tonsillectomized children. For purposes of fair sampling, the study should be made of not less than 2,000 children from coast to coast.

At the time the child is admitted to the hospital for tonsillectomy, an additional record card (4 by 6 inches) should be made out and attached to the case history card, with the following information: name, address, sex, age, color, hospital case number, date of tonsillectomy. At the bottom of the card space should be provided for the results of the follow up: child is well, child has contracted poliomyelitis, type of involvement (bulbar, bulbar-spinal, spinal, abortive), date of onset. Three lines, with four spaces each, are to be provided for the three months of follow-up.

When the child is discharged from the hospital, the card should be detached from the history card and placed in a tickler file with the date noted for follow-up. The file should be placed in the social service department, and the follow-ups are made by personal visit, telephone or postcard at weekly intervals. The parents should be advised at the time of tonsillectomy that follow-up will be made, in order to secure their cooperation. At the end of the study, which should be January 1, all cards should be sent to one station for tabulation. It is suggested that if the follow-up work is too much for an understaffed social service department, medical students can be hired to conduct the follow-up, working with the social service departments. The results of such a study will give a fair comparison as to the incidence of poliomyelitis occurring in tonsillectomized children and the incidence of that occurring in the general child population.

There are several other points worthy of mention.

Tonsillectomies are performed usually in the summer months, not entirely as a matter of convenience to the surgeons or the children. The summer months, with their low incidence of respiratory infections, offer the ideal time for such a procedure. If the present practice of summer tonsillectomies is to be changed as it appears already to be changing because of fear of poliomyelitis, then the dangers of respiratory infections will substantially increase. To incur that increased risk, laryngologists must have proper justification. To expose their patients to such dangers because of an unfounded fear would not be good medicine.

TABLE 1.—*Age Distribution of Cases of Poliomyelitis and of Cases of Each Type of Involvement, with the Number Preceded by Tonsillectomy and the Number Preceded by Other Operative Procedures*

Age	Total Cases			Bulbar			Bulbar-Spinal			Spinal			Mild			Unknown		
		Number Following			Number Following			Number Following			Number Following			Number Following			Number Following	
	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations
Total	2,476	62	27	382	18	9	62	5	..	1,292	24	11	616	14	6	124	1	1
Under 5 years	658	16	2	67	2	1	13	1	..	394	10	..	150	3	1	34	..	..
5 to 9	807	35	10	132	14	5	19	3	..	384	10	2	226	7	3	46	1	..
10 to 14	484	4	3	94	1	..	13	..	..	229	1	3	129	2	..	19	..	..
15 to 19	227	4	5	36	..	1	9	1	..	110	1	3	58	2	..	14	..	1
20 to 24	105	2	3	19	..	1	2	..	..	61	2	1	20	..	1	3	..	..
25 and over	180	1	4	33	1	1	6	..	..	108	..	2	26	..	1	7	..	..
Unknown	15	..	..	1	..	..	..	..	..	6	..	..	7	..	..	1	..	..

TABLE 2.—*Geographic Distribution of Cases of Poliomyelitis and of Cases of Each Type of Involvement, with the Number Preceded by Tonsillectomy and the Number Preceded by Other Operations*

State	Total Cases			Bulbar			Bulbar-Spinal			Spinal			Mild			Unknown		
		Number Following			Number Following			Number Following			Number Following			Number Following			Number Following	
	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations	Cases	Tonsillectomy	Other Operations
Total	2,476	62	27	382	18	9	62	5	..	1,292	24	11	616	14	6	124	1	1
New York city	596	21	1	68	1	..	16	2	..	254	10	..	205	7	1	53	1	..
New York state	135	1	..	15	..	..	4	..	..	61	..	..	53	1	..	2	..	..
New Jersey	229	4	5	33	2	1	8	1	..	101	1	3	74	..	1	13	..	..
Delaware	33	1	..	4	..	..	..	..	..	11	..	..	18	1	..	..	..	..
New Hampshire	141	5	2	48	4	..	6	..	..	63	..	2	16	1	..	8	..	..
Massachusetts	306	7	2	47	4	1	7	..	..	158	2	1	94	1	..	..	..	..
Maryland	20	1	3	9	1	2	..	..	..	4	..	..	7	..	1	..	..	..
South Carolina	16	..	..	..	..	..	..	..	..	..	..	..	15	..	..	1	..	..
Illinois	257	5	..	38	1	..	9	..	..	202	4	..	8	..	..	..	..	..
Ohio	316	9	9	71	2	4	8	2	..	126	2	3	100	3	2	11	..	..
Arkansas	312	5	3	30	1	1	1	..	..	237	4	1	8	..	..	36	..	1
South Dakota	15	..	..	2	..	..	..	..	..	10	..	..	3	..	..	..	..	..
Idaho	22	..	1	..	..	..	..	..	..	18	..	..	4	..	1	..	..	..
Oregon	78	3	1	17	2	..	3	..	..	47	1	1	11	..	..	..	..	..

It has also been stated that because tonsillectomy is an elective operation it may be postponed for months during the season of epidemic poliomyelitis without any difficulty. The majority of tonsillectomies are not elective however. Most of them are necessary surgical procedures, performed in the interest of preventive medicine. Infected tonsils are possible etiologic foci for nephritis, mastoiditis, middle ear infection, rheumatic fever and many other debilitating diseases. For the full protection of his patient, the surgeon, before postponing an indicated tonsil-

TABLE 3.—*Distribution by Types of Involvement: Number and Percentage of Cases of Poliomyelitis of Each Type Preceded by Tonsillectomies and by Other Operations*

Type of Involvement	Total Number of Cases	Cases Preceded by Tonsillectomies		Cases Preceded by Other Operations	
		Number	Per Cent	Number	Per Cent
Total	2,476	62	2.5	27	1.1
Bulbar	382	18	4.7	9	2.4
Bulbar spinal	62	5	8.0	..	0.0
Spinal	1,292	24	1.9	11	0.8
Mild	616	14	2.3	6	1.0
Unknown	124	1	0.8	1	0.8

TABLE 4.—*Distribution by Age Group: Number and Percentage of Cases of Poliomyelitis Preceded by Tonsillectomies and by Other Operations in Each Age Group*

Age	Total Cases of Poliomyelitis	Cases Preceded by Tonsillectomies		Cases Preceded by Other Operations	
		Number	Per Cent	Number	Per Cent
Total	2,476	62	2.5	27	1.1
Under 5 years	658	16	2.4	2	0.3
5 to 9	807	35	4.3	10	1.2
10 to 14	484	4	0.8	3	0.6
15 to 19	227	4	1.8	5	2.2
20 to 24	105	2	1.9	3	2.8
25 and over	180	1	0.5	4	2.2
Unknown	15	6	0.0	..	0.0

lectomy, must weigh the dangers and the chances of the contraction of any one of these diseases as well as the dangers and the chances of poliomyelitis.

Therefore I strongly urge that another study be made to answer the question, "Are children on whom tonsillectomy is performed during the summer months more likely to contract poliomyelitis than non-tonsillectomized children of the general child population?"

Table 1 shows the cases of poliomyelitis by age groups, types of involvement, and operative procedures undergone preceding the onset. As might be expected, the greatest number of cases of each type of poliomyelitis occurred in the 5 to 9 year group with exception of those of the spinal type. The "under 5 year" group with this type slightly

outnumbered the 5 to 9 year group. Also to be expected was the fact that the largest number of cases in which tonsillectomy preceded poliomyelitis also occurred in the 5 to 9 year group, that being the age group most frequently undergoing tonsillectomy.

Table 2 shows the cases distributed by states, types of involvement, and operative procedures. The city of New York is listed apart from the rest of the state.

Table 3 lists the cases by types of poliomyelitis, with the number and the percentage preceded by tonsillectomy and the number and the percentage preceded by other operations. Of the 2,476 cases of poliomyelitis recorded, 62 were preceded by tonsillectomies—a percentage incidence of 2.5. Of the total group (2,476 cases), 27 were preceded by other types of operations—a percentage incidence of 1.1 or less than one-half that of poliomyelitis following tonsillectomy. Of the 382 cases of the bulbar type, 18 were preceded by tonsillectomies, and 9, by other operations, the percentage incidence being 4.7 and 2.4, respectively. Of the 1,292 cases of the spinal type, 24 followed tonsillectomies and 11 followed other operations, the percentage incidence being 1.9 and 0.8 respectively.

Table 4 lists the cases of poliomyelitis by age groups, with the number and the percentage preceded by tonsillectomies and the number and the percentage preceded by other operations. In the 5 to 9 year group, comprising 807 cases, 35 followed tonsillectomies—a percentage incidence of 4.3.

Table 5 lists the cases of poliomyelitis according to states, with the number and the percentage preceded by tonsillectomies. In the city of New York there were recorded 596 cases of poliomyelitis, 21 of which had been preceded by tonsillectomies—a percentage incidence of 3.5. Ohio, with 316 cases, had 9 (2.6 per cent) following tonsillectomies, and New Jersey, with 229 cases, had only 4 (1.7 per cent) following tonsillectomies—less than half the incidence found for New York.

What is the significance or interpretation of the data? It would be both unfair and unwise to attempt an interpretation, for the reasons already set forth. There is one possible exception. Table 3 shows that 4.7 per cent of the cases of bulbar involvement were preceded by tonsillectomies, while only 1.9 per cent of the cases of spinal involvement followed recent tonsillectomies. But even in this instance not too much importance can be placed on the interpretation because of the inadequacy of the original data and the lack of comparative values.

There is one more point of interest in this study. Dr. John A. Anderson made a study of the epidemic which occurred in Utah in 1943. Poliomyelitis was reported to have occurred in 232 children between the ages of 3 and 16. In 17 of these it was preceded by tonsillectomy. When one calculates the percentage incidence, one finds it to be 7.3

per cent for the Utah study, compared with 2.5 per cent in the present report. Furthermore, Dr. Anderson found that 46 per cent of the cases of bulbar involvement were preceded by tonsillectomies, contrasted with 4.7 per cent in the present study. The wide difference of these findings

TABLE 5.—*Distribution by States: Number and Percentage of Cases of Poliomyelitis Preceded by Tonsillectomies in Each State*

State	Total Cases of Poliomyelitis	Cases Preceded by Tonsillectomies	
		Number	Per Cent
Total	2,476	62	2.5
New York city	596	21	3.5
New York state	135	1	0.7
New Jersey	229	4	1.7
Delaware	33	1	3.0
New Hampshire	141	5	3.5
Massachusetts	306	7	2.3
Maryland	20	1	5.0
South Carolina	16	..	0.0
Illinois	257	5	1.9
Ohio	316	9	2.8
Arkansas	312	5	1.6
South Dakota	15	..	0.0
Idaho	22	..	0.0
Oregon	78	3	3.8

TABLE 6.—*Deaths from Poliomyelitis*

Age Group	Cases of Poliomyelitis	Number in Which Death Resulted	Case Fatality Rate
Total	2,476	120	4.8
Under 5 years	658	23	3.5
5 to 9	807	27	3.3
10 to 14	484	25	3.2
15 to 19	227	15	6.6
20 to 24	105	9	8.6
25 and over	180	20	11.1
Unknown	15	1	6.7

TABLE 7.—*Bulbar Type of Poliomyelitis*

Total number of cases of poliomyelitis	2,476
Total number of cases of bulbar type	382, or 15.4%
Cases following tonsillectomy	18, or 4.7%
Cases following other operations	9, or 2.4%
Cases following no operations	355, or 14.3%

is a subject for more than mere speculation. Dr. Anderson's study was well conducted. It certainly was true of Utah, more particularly Salt Lake City, in 1943. Is it true of the nation as a whole or only of that particular community at that time?

No one has produced the answer as yet. It is of primary interest to the individual physician concerned for the safety and well-being of his patients, as well as of intrinsic interest to the members of this society, that a definite answer be found in the near future.

This survey, which was initiated in good faith and cooperation, has not produced the conclusive results expected. But it will produce the desired results if it can be carried on during this year. I strongly urge that the members continue their cooperation and I am certain that the task will not be so difficult, now that all have learned exactly what is required. If this study can be correlated with the follow-up of tonsillectomized children, by this time next year the relationship of tonsillectomy and poliomyelitis will be better understood.

Unfortunately, the reports on the states of Connecticut, Florida and Minnesota were rceived too late to be incorporated in the body of this paper.

There were 572 cases of poliomyelitis in the state of Florida. One case followed recent tonsillectomy, and the involvement was of the mild type.

There were 122 cases of poliomyelitis in Connecticut. Four cases followed recent tonsillectomies. One case was of the bulbar type, 1 of the spinal type and 2 were reported as being of the mild type.

In the heavy epidemic state of Minnesota there were 2,702 cases of poliomyelitis. Twenty-four cases followed recent tonsillectomy. Thirteen of these were of the bulbar type, and 11 of the spinal type.

With the addition of these three states, the figures on the charts would be altogether different.

A grand total of 5,872 cases has been reported, which is over 23 per cent of the cases of poliomyelitis reported in the entire country for 1946.

Of this total number, 91 cases (1.6 per cent) followed recent removals of tonsils.

121 East Sixtieth Street.

HEALING OF EXPERIMENTAL LABYRINTHINE FISTULAS

Further Observations

J. R. LINDSAY, M.D.
CHICAGO

IN A PREVIOUS REPORT [1] it was pointed out that the closing of a labyrinthine fistula by new bone may occur from two sources, the periosteal surface and the endosteal surface of the fistula. Factors which influence osteogenesis at these two surfaces were discussed.

In addition to the problem of osteogenetic closure of the fistula, experience with human subjects [2] has focused attention on a further problem which may influence the functional result, the occurrence of a depression of hearing due apparently to an involvement of the sense organ of the cochlea which has been referred to as "postoperative labyrinthitis."

The present report will be limited to the first of these problems, particularly to the prevention of the bony closure that originates from the periosteal surface.

A number of observations relating to this problem were presented two years ago [1] and may be summarized:

1. Meatal skin flap. In the monkey's ear bony closure of the fistula occurred whenever a meatal skin flap was used without removal of the upper rim of the annulus tympanicus. This was interpreted as due to a tendency of the flap to shrink away from the fistula during healing, allowing osteogenesis to intervene. The fistula inevitably lay in somewhat of a concavity. Bony closure occurred in the ear within a few weeks, the new bone being laid down between the flap and the smooth prepared surface of the labyrinthine capsule around the fistula. This bone has been interpreted as "periosteal" in origin since it occurs also if the endosteum has not been exposed, but in most of the cases there was no

---

From the Division of Otolaryngology, University of Chicago.

This work was aided by a grant from the Central Bureau of Research of the American Otological Society.

Presented before the Otosclerosis Study Group at the annual meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago, Oct. 13, 1946.

1. Lindsay, J. R.: Histologic Observations on the Healing of Labyrinthine Fistula in Monkeys, Arch. Otolaryng. **43**:37-48 (Jan.) 1946.

2. (*a*) Lempert, J.: Lempert Fenestra Nov-Ovalis with Mobile Stopple, Arch. Otolaryng. **41**:1-41 (Jan.) 1945. (*b*) Shambaugh, G. E., and Juers, A. L.: Surgical Treatment of Otosclerosis, ibid. **43**:549-567 (June) 1946.

clear demarcation as regards bone of endosteal origin. In later experiments, when the covering flap had been successfully applied and periosteal bone thereby excluded, it was found that the fistula was closed by endosteal bone, more slowly, the closure usually becoming complete only after a period of months.

2. Epidermal or Thiersch graft. The epidermal or Thiersch graft was used successfully in preventing bony closure of the fistula in several ears. Failures were frequent for two principal reasons: The graft underwent degeneration, and hair fragments which occasionally were present on the under surface or projected through the graft stimulated formation of callus at the edges of the fistula. The use of an epidermal or Thiersch graft derived from a hair-bearing surface was therefore shown to be inadvisable.

3. Conjunctival graft. Bony closure of a fistula was prevented by the use of a conjunctival graft, epithelium outward. The method was not considered to be clinically applicable but was thought to warrant further investigation. The results will be discussed later.

4. Full thickness graft of thin skin and periosteum obtained from the bony wall of the external auditory canal and the tympano meatal flap. These were found to be the most successful means yet tried in the animal experiments to prevent bony closure of the fistula. Further observations, including the histologic studies, have since become available in this group.

The opinion was stated that a factor predisposing to the successful use of any covering flap appeared to be a cavity and a fistula prepared in such a way that the latter was located on a convex surface or a mound rather than in the depth of a concavity. Such a site can be obtained by making the fistula slightly distal to the ampulla after the posterior rim of the annulus tympanicus has been adequately removed. The draping of the skin flap over a mound apparently predisposes it to maintain close contact with the bony margins of the fistula.

It was also stated that prevention of endosteal closure of the fistula appeared to depend primarily on removing bone flakes with their attached endosteum in such a way as to avoid injuring the endosteum beyond the margins of the fistula and to permit the uninjured membranous canal to maintain its normal position at the outer periphery of the bony canal and thereby to come into apposition with the covering flap. The early union of the two smooth raw surfaces which are thus brought into apposition appeared to be the essential factor in the prevention of osteogenetic closure.

Further observations on osteogenesis occurring within the lumen of the bony canal and its relation to late closure of the fistula and to depression of function will be presented in a later report.

FURTHER OBSERVATIONS ON FACTORS INFLUENCING PERIOSTEAL CLOSURE OF THE FISTULA

1. *The Conjunctival Graft.*—Following the previous demonstration [1] that a fistula could be kept open by a conjunctival graft with epithelial surface outward, grafts of this type were used in 7 additional ears. A tendency of the conjunctional graft to degenerate was evident in all of these ears. The epithelium showed greater tendency to degenerate than the subepithelial connective tissue layer. Such grafts are thicker than those obtainable from a skin surface, and the epithelium is not adapted to forming the lining of a mastoidectomy cavity.

Comment: The complete series of experiments has served only to demonstrate that it is possible to maintain an open fistula with the conjunctival graft but that this type of graft is not suitable for clinical use.

2. *The Graft of Full Thickness Skin and Periosteum Obtained from the Bony Wall of the External Auditory Canal.*—Grafts of this type were used in 3 ears. No hairs were seen in these grafts on histologic examination.

In the first monkey the fistula response disappeared after one week. Bone regeneration was fairly extensive in the perilymphatic space, with obliteration of the endolymphatic space similar to that described by Engström.[3] The bone bordering the fistula showed evidence of fairly extensive resorption along vascular channels and here was being replaced by new bone. A continuous well healed skin flap covered the area of the fistula, but two epidermal masses or cysts were found beneath the flap just anterior to the fistula.

In the second monkey the fistula was open at seven months, when the animal was killed, but partial bony closure had occurred apparently as a result of bone fragments having slipped beneath the margins of the fistula, which had distorted the membranous labyrinth.

In the third monkey the fistula was widely open at fourteen months, when the animal was killed. The flap covering the fistula was stripped away during preparation of the specimen, exposing but not tearing the membranous canal. At the site where the fistula had remained open the membranous canal had obviously been united directly to the covering layer with a minimum amount of connective tissue between (fig. 1).

Comment: This type of graft, although consisting of full thickness skin and periosteum, is free from hair and glands and is not thicker than a suitable Thiersch graft.

The disadvantages of this type of graft are its tendency to undergo degeneration and the possibility that small remnants of epidermis per-

3. Engström, H.: Ueber das Vorkommen der Otosklerose nebst experimentellen Studien ueber chirurgische Behandlung der Krankheit, Acta oto-laryng., 1940, supp. 43, pp. 1-153.

sisting at the edges may become buried beneath the flap and later develop into inclusion cysts or masses of epidermis. These might conceivably lead to later complications. A graft of this type seems to be the covering of choice when the tympanomeatal flap has been torn or mutilated during preparation.

3. *The Tympanomeatal Flap, Consisting of the Thin Skin and Periosteum of the Bony External Canal Attached to the Tympanic Membrane.*—A flap of this type was preserved and reflected over the fistula after removal of the annulus tympanicus, the incus and the head of the malleus as in the Lempert nov-ovalis operation in 16 ears.

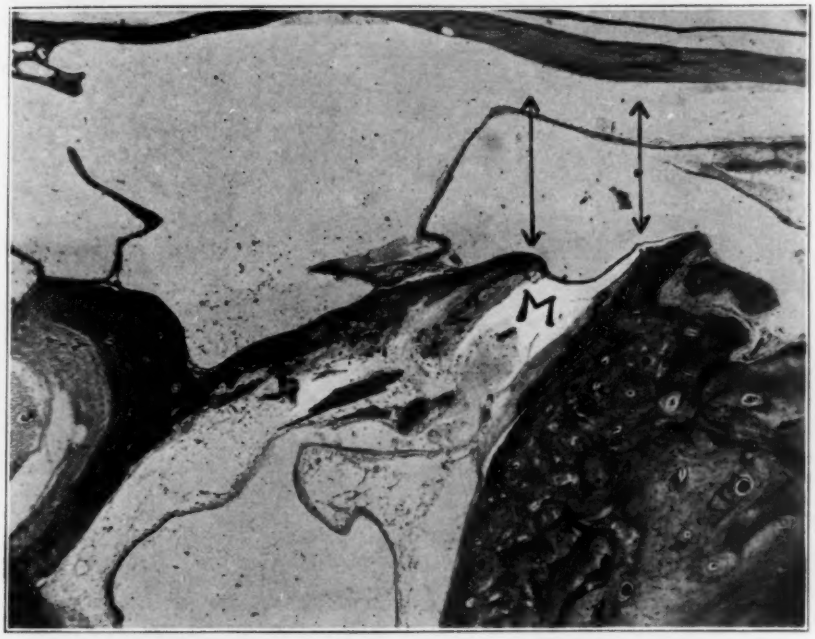


Fig. 1.—Photomicrograph of a section through a fenestra which was made fourteen months earlier and covered by a graft of skin and periosteum from the anterior wall of the external auditory canal.

The covering flap was stripped away from the bone and the fenestra during the preparation of the specimen (arrows). New bone, which appears to be mainly of endosteal origin, is seen at the margins of the fenestra, closing off the perilymphatic space, but does not extend across between the membranous canal and the covering layer or flap.

The width of the open fenestra is that of the membranous labyrinth (*M*).

Splinters of bone which escaped removal at operation have caused distortion of the membranous labyrinth near the ampulla.

In 3 monkeys the test for fistula never became positive after operation. The reason was not evident on histologic examination. In another, suppurative labyrinthitis occurred in the sixth month, probably as a result of injury during cleaning and testing of the ear.

Of the remaining 12 fistulas, 8 were either closed by new bone or showed active osteogenesis to the extent that ultimate closure might be expected. In regard to most of these the osteogenesis could be attributed to endosteal activity rather than to failure of the flap to exclude development of periosteal bone.

Two remained open at the time at which the animals were killed, five and one-half and six and one-half months after operation, respectively. The diameter of each had been greatly reduced by encroachment of marginal new bone. A thin seam of bone was present between the flap and the outer margin of the enchondral layer of the capsule, but most of the osteogenesis had arisen where the endosteum and the membranous canal were depressed by bone chips (fig. 2).

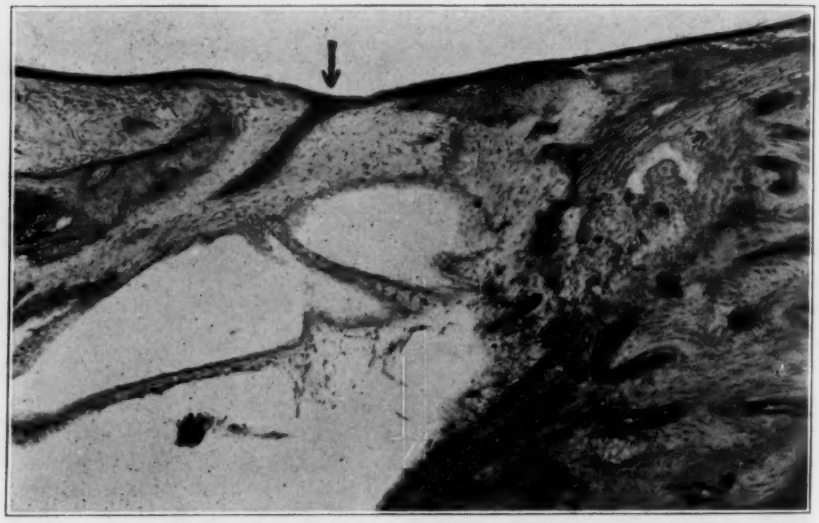


Fig. 2.—Photomicrograph of a section through a fenestra which was made six and one-half months earlier and covered by a tympanomeatal flap. An irregular layer of new bone has been deposited against the old bone beneath the flap.

Endosteal bone has also formed at the margins and cannot be differentiated from bone of periosteal origin. Small bone fragments have caused some depression of the membranous canal.

The fenestra has been greatly narrowed, and osteogenesis has probably not reached an end point, but a downward projection of epidermis (arrow) at one point reaches almost to the membranous canal, with only a thin layer of connective tissue between. It appears that at this point osteogenetic closure may be prevented and a small permanent fistula result.

One fistula was open at fourteen months, when the animal was put to death. The end of the fistula nearest the ampulla had closed over by osteogenesis, but throughout most of its length the fistula was open for the full width of the membranous canal. The membranous canal was apparently attached to the flap by a thin layer of fibrous connective tissue (fig. 3).

Some osteogenesis had occurred at the margins but had ceased at the point where the membranous canal and the covering flap were attached to each other.

One fistula was open at five months (43 R) at the time the animal died from meningitis, which was a complication of an infection of the opposite ear. The ear operated on presented the unusual complication of a skin flap invaginated into the fistula (fig. 4). The invaginated portion which lay in the ampulla had ruptured into the endolymphatic space,

Fig. 3.—Photomicrograph of a section through a fenestra which was open at fourteen months. The membranous canal appears to be definitely attached to the covering skin flap by a thin layer of connective tissue. The fenestra has been made about the width of the membranous canal and is completely occupied by it. A thin seam of periosteal bone has been deposited beneath the flap at the left (arrow), but practically no new bone of endosteal origin has formed.

with exfoliated epithelial cells being disseminated into the utricle, which had apparently also ruptured. Epithelial cells were dispersed in the perilymphatic cistern, the scala vestibuli and the upper turns of the scala tympani. The saccule contained a few epithelial cells, but the cochlear duct was free.

The fistula response had remained positive until the animal succumbed. The state of cochlear function was not known, but the hair cells and the ganglion cells appeared well preserved.

Comment: The histologic examination has demonstrated that although at operation the technic appeared to be carried out faultlessly the complete removal of bone dust and fragments was rarely accomplished. While the factors contributing to success or failure often could not be clearly separated, it was possible to gain significant information from the group as a whole.

Failure to maintain an open fistula was in most cases due to the osteogenetic process which took origin from the endosteal surface at the margins. This was dependent on several factors, only one of which

Fig. 4.—Photomicrograph of a fenestra made five months earlier and covered by a tympanomeatal skin flap. The flap has invaginated into the fenestra. Exfoliated epithelium has been retained in the pocket thus formed, filling the ampulla, and has ruptured into the membranous labyrinth. Loose, desquamated cells are therefore seen in the ampulla of the superior semicircular canal (arrow) and also occupied the utricle (at a lower level than is shown in this section). The utricle had also ruptured, with further dissemination of desquamated cells. The fistula response was active, however, until the day the animal died of meningitis from infection of the opposite ear.

concerned the type of covering flap used and the manner of applying it. A discussion of these factors is planned, to be published at a later date; the present report will be confined to the question of the covering used and its effect on osteogenesis. The successful application of the tympanomeatal flap appeared to be favored by the site of the fistula and the method of creating it.

The most favorable site appeared to be a short distance from the ampulla. By extensive removal of the posterior rim of the annulus and all air cells above and posterior to the horizontal canal the fistula can be made to occupy the most prominent surface of a mound and the flap may be draped over it. The flap does not then tend to pull away from the bone at the fistula during the healing process.

When the fistula was made over the ampulla, either it closed entirely, or the end which lay over the ampulla closed off. This was due apparently to several factors: Bone chips are sometimes lost in the ampulla; the fistula located at the ampulla tends to be in a concavity, and this creates greater difficulty in maintaining the flap in position; there appears also to be a tendency for the air in the middle ear to force its way back into the epitympanum and thereby to lift the flap away from a fistula which is directly on the ampulla. In a few cases such an air pocket was found to have separated the flap from the fistula.

In each case in which the fistula remained open and osteogenesis appeared to be at or near the end point, the layer of fibrous connective tissue between the membranous canal and the flap was quite thin, but that the canal was attached to the flap seemed definite (fig. 3). This appears to support the interpretation that union of the smooth raw surfaces of the membranous canal and the covering flap may have provided the necessary barrier against ingrowth of osteogenetic cells. The circumstance that the membranous labyrinth is in a favorable position to unite with the flap appears to be an essential factor in making a permanent fistula or fenestra of a semicircular canal possible.

It is significant also that in cases in which the fistula had been kept open for periods of more than a year there was invariably some deposit of bone, although not always a continuous layer, between the covering flap and the outer surface of all layers of the bony capsule. In no case had bone been completely prevented from being deposited beneath the flap. Only in the region where the membranous labyrinth was attached to the flap by a very thin connective tissue layer did bone fail to intervene.

The possibility of forcing a fold of the covering flap into the fistula and thereby creating a secondary cholesteatoma within the labyrinth as shown in figure 4 would appear to be greater in the human ear because of the greater width of the fistula. Such an occurrence would inevitably produce serious damage of the inner ear at some later date.

4. *Effect of Irradiating with Roentgen Rays Within the First Week After Operation.*—Six ears were exposed to 600 roentgen units each between the second and the fourth day after operation. These ears are also included in the two preceding groups.

Two of these fistulas remained open until the animals were killed at fourteen months and are shown in figures 2 and 3.

In 1 ear, secondary cholesteatoma developed in the labyrinth from invagination of the flap (fig. 4). In 1 ear acute diffuse suppurative labyrinthitis developed at five months. The pathway could not be determined with certainty, but a dislocation of the stapes suggested that invasion of the labyrinth might have followed trauma occurring when the animal was tested for fistula response. One fistula closed after six months and another after two weeks. Bone fragments which had escaped into the fistula at operation appeared to have been the main factor predisposing to osteogenesis in these 2.

Comment: It is obvious that when several factors may be involved in the success or the failure of the effort to prevent osteogenesis in each case, the effect of one factor, such as irradiation, is not readily interpreted.

An improved operative technic and the type of covering used (a tympanomeatal flap or a graft from the anterior wall of the external auditory canal) appear, on the basis of previous experience, to have been important contributing factors, so that a favorable effect of radiation could not be inferred.

5. *A Cartilaginous Graft Fitted into the Fenestra as a "Stopple"*[2a] *and Covered by a Tympanomeatal Pedicle Flap.*—This was tried in 14 ears.

The graft was prepared from the cartilage of the helix. Since in the monkey the fistula is smaller than in the human subject, considerable difficulty was experienced in preparing a suitable stopple.

The spine of the helix was not found to be as suitable as it is in the human subject. In place of a stopple which has only two cut surfaces, the external and the internal, which is available for the human ear when a slice is cut from the spine at the appropriate level, the stopple used in the animal was freshly cut cartilage on nearly all surfaces and consequently was more likely to have dents and irregularities which would permit ingrowth of bone with eventual fixation.

Fourteen ears were operated on by this method. In some the stopple was fitted snugly, and in some it floated freely. It was always made more shallow than the depth of the lumen of the bony canal so that the membranous canal would not be compressed to the opposite wall. Consequently, if displaced into the bony canal, the stopple might slip forward into the ampulla.

All the monkeys were killed between four and six months after operation.

Eight fistulas closed between the time of the removal of packing and four months. One never gave a positive reaction, and the ear proved to have diffuse serous labyrinthitis on histologic examination.

Five fistulas gave a positive reaction within a few days before the animals were killed between four and six months after operation.

Fig. 5.—*A*, photomicrograph of a cartilaginous stopple in a fenestra made five months earlier. The fistula test was positive. The portion of the cartilage which projects into the perilymphatic space shows a loose fibrillar network of connective tissue around it but little tendency to attract deposition of bone. New bone has been deposited on both the endosteal and the periosteal surface of the bony margin of the fistula at the left and has extended (as outlined) about half way across the fenestra between the flap and the depressed stopple.

B, photomicrograph of a cartilaginous stopple in a fenestra at five months. The fistula test was negative after two weeks. The stopple had been fitted loosely and became depressed.

New bone of endosteal origin has formed on each side of the stopple and has grown into small niches in the side of the cartilage (arrows), insuring fixation by ankylosis.

In this series the results were shown on histologic examination to be almost uniformly poor for a number of reasons. It should be pointed out again, however, that the experiments were not comparable to the operation carried out on human ears.

A number of observations were possible, which may be applied to the human subject.

Along free edges or borders of a cartilage graft which projected into the lumen of the perilymphatic space beyond the margins of bone and endosteum a thin connective tissue meshwork always developed, but the tendency for new bone to be deposited along borders of the cartilage which lay free in the perilymphatic space appeared to be slight (fig. 5 *A*).

The sides of the stopple which come into contact with the margins of the bone and the endosteum were always found to have new bone closely applied. Any depression or nick in the cartilage became filled with new bone, which thereby tended to fix the cartilage firmly in the fenestra (fig. 5 *B*).

In all cases in which a loose stopple was applied, it was found to have been depressed into the lumen of the bony canal, thereby displacing and collapsing the membranous canal. Also, when the stopple was inserted so as to fit snugly, it usually became depressed at least at one end.

Inward displacement of the stopple was always associated with increased fibrosis and osteogenesis in the perilymphatic space (fig. 6 *A*). This occurred probably because of the additional trauma of the endosteum caused by displacing the membranous canal, to which it is attached, and also the increased stasis produced by the blocking off of the perilymphatic space.

When the covering flap was in apposition to the stopple, osteogenesis seemed to be inhibited externally, but depression of the stopple allowed a layer of bone to develop between the stopple and the flap (fig. 6 *B*).

Postoperative labyrinthitis occurred in 1 ear, and in a second a moderate degree of hydrops was found, together with extensive degeneration of neural elements.

The osteogenesis and fibrosis occurring in the perilymphatic space at the site of the fistula were more extensive in these ears than in those in which no stopple was used. This was always associated with a fairly extensive bone change in all layers of the labyrinthine capsule along the margins of the fistula, consisting of absorption and formation of channels, which were later filled by new bone (figs. 5 and 6).

Comment: The cartilage used as a graft or stopple in the fistula did not degenerate. When the under surface of the cartilage and the membranous canal were in apposition, new bone did not grow in between. The same observation applied to the covering flap. However, any depression of the cartilage relative to the level of the bony margins permitted bone to grow between the cartilage and the flap.

Fig. 6.—*A*, photomicrograph of a cartilaginous stopple in a fenestra at four and one-half months. The fistula test was positive. New bone has not formed between the cartilage and the flap, but the depression of the membranous canal which occurred when the stopple was inserted is illustrated. The endosteum has also been depressed at the end nearest the ampulla, and a dense block of new bone is in the process of formation.

There has been active resorption of bone along vascular channels, with new bone replacement, in the enchondral and periosteal layers of the labyrinthine capsule at the margins.

B, photomicrograph of a cartilaginous stopple in a fenestra at almost five months. The fistula response was moderately active three weeks earlier. The loosely fitting stopple has been depressed, carrying the membranous canal with it, and bony closure has become complete.

The labyrinthine capsule bordering on the fenestra shows extensive resorption of bone in all three layers, along vascular channels, with new bone (lighter staining with eosin) being laid down in the spaces thus created.

The successful use of a stopple of cartilage would appear to demand that the stopple lie even with or project slightly from the bony margins and fit snugly enough to prevent dislocation inward. Its under surface should lie in contact with the membranous canal but should depress the latter to a minimum. Displacement of the membranous canal is undesirable, as is also any tendency to block off the perilymphatic space.

The margins of the cartilage should be smooth. The use of a stopple sliced from the spine of the helix recommended by Lempert probably offers a definite advantage in that the edges do not require to be cut and may still have connective tissue fibers present. The possibility of bony fixation is thereby reduced.

The chief disadvantages of the stopple appear to be the technical difficulty of securing an ideal fit and the tendency for the amount of osteogenesis in the perilymphatic space at each end of the fistula to be increased because of unavoidable depression of the membranous canal and consequent injury of the endosteum, with increased stasis in the perilymphatic space.

6. *Prevention of Bony Closure of a Labyrinthine Fistula of the Human Ear Without Application of a Covering Flap.*—Two cases are described.

Two patients with unilateral Ménière's disease which could not be controlled by medical therapy were submitted to operation. These were 2 of a series of patients on whom certain intralabyrinthine procedures were carried out through a fenestra made in the horizontal canal near the ampulla.

The details of the histories and the auditory examinations may be omitted for the purpose of this report. Each patient had a fluctuating threshold hearing loss of from 40 to 60 decibels for speech frequencies, more marked for low than for high tones, and a positive Rinne test of the affected ear. The caloric test produced a response that was within the normal range for cold stimulation. The tympanic membranes were normal.

The operative procedure used with each patient was as follows:

A postauricular incision was made, and the cells of the mastoid process were exenterated.

The horizontal canal was exposed and skeletonized along its anterior limb without injuring the ligamentous attachment of the incus or removing the bony wall of the external auditory meatus.

A fenestra was made with the dental burnishing burr on the most prominent part of the mound of the canal, just distal to the ampulla. In one case, a large fenestra was made, and all bone dust and endosteum were removed. In the other case, less care was exercised, since the fistula was expected to close, and some bone fragments undoubtedly remained.

In both cases a small smooth coagulation needle was introduced along the outer periphery of the bony canal, through the ampulla, until the point impinged on the bony wall of the vestibule. The instrument therefore passed through the nerve to the ampulla of the horizontal canal and may have entered the superior part of the nerve to the utricle. It was withdrawn and the instrumentation repeated once. No hemorrhage was seen, and no injury of the membranous canal could be detected. Bone chips had been removed from the mastoidectomy cavity by irrigation, and none were seen to escape into the middle ear.

No attempt was made to cover the fenestra in either case, or to save or replace mucoperiosteum at the fistula. A small amount of sulfathiazole crystals was sprinkled in the mastoidectomy cavity, and the wound was closed. Penicillin was given by intramuscular injection postoperatively.

The wound healed by first intention in each case.

The degree of postoperative vertigo was moderate for about three days, and during this time discomfort due to that phenomenon was aggravated by postural changes, possibly influenced by changes in the tension on the bandage.

Each patient was able to be out of bed in less than a week.

During ensuing weeks considerable vertigo was noted on sudden changes of position. Pressure changes in the outer meatus produced a positive fistula response, and pressure with the finger immediately above the anterior root of the helix also produced active nystagmus, which reversed in direction for a few jerks on release of the pressure.

The auditory function was markedly reduced in the ear operated on, in both cases, but definite remnants of hearing could be detected. The roaring noises varying in intensity from day to day which are characteristic of Ménière's disease persisted without much change in severity.

While it was expected that both fistulas would close within a few months, this did not occur. One fistula remained active for a period of about fifteen months, at which time a second operation was done.

The other fistula is still active after about one and a half years.

Both patients had relief from the severe dizzy spells except for a few occasions when recurrence was noted. Dizziness could be brought on by strenuous nose blowing.

Both patients complained that there was a sensation of unsteadiness in the presence of loud noises, also that loud noises caused discomfort in the ear, although on testing with masking of the good ear the hearing loss for pure tones was over 80 decibels.

Examination revealed that in both cases the ear operated on exhibited an active Tullio phenomenon. The nystagmus could be produced by several tones of the audiometer when intensities were near the maximum. Also, the Bárány noise apparatus produced an active Tullio response from the ear operated on.

One patient was operated on a second time with the object of determining the local condition in the ear and of destroying labyrinthine function to obtain relief from vertigo. The drum membrane, the middle ear and the eustachian tube were normal, and cold stimulation produced a normal response.

The mastoidectomy cavity was reopened through the old scar. It was occupied by a single large air space or cell with a bluish gray mucoperiosteal lining. The fenestra could be seen through this layer of mucoperiosteum. The mucoperiosteal covering was peeled off, and the membranous canal was revealed in its normal position. Deviation of the eyes could be produced by manipulation at the fistula. The microscope was not used, but as far as could be seen with a magnification of about two and one-half times the perilymphatic space seemed open. The membranous canal was removed and the cavity closed after dusting with sulfathiazole crystals. The patient's postoperative course was typical for acute destruction of the labyrinth. Attacks of vertigo have not returned to date.

Comment: These 2 cases are described because of the information they afford on the question of the healing of a labyrinthine fistula. They were the only cases in which this method of operating was tried, and in them the results were identical. From the standpoint of the

prevention of osteogenetic closure of the fistula they are of the greatest interest.

The fact that hearing was reduced is not significant since the patients were subjected to instrumentation within the labyrinth with the intent to damage tissue. The Tullio reaction is also of only passing interest here, since there is evidence on record that this phenomenon depends in part on function of the conducting mechanism and probably could not be produced in the presence of fixation of the stapes. This phenomenon has not been demonstrable in our cases of otosclerosis after fenestration.

The essential feature is that an open fenestra was produced in the horizontal canal by this simple method without the mucoperiosteum being replaced or any covering applied to the fistula at operation. Healing of the fistula without bony closure occurred when mucoperiosteum grew across it, which was sufficiently thin to permit the fistula to be seen through it.

Several factors must be considered as contributing to this result. The manner of making the fistula and the care taken to preserve the continuity and normal position of the membranous canal are basic requirements which were apparently fulfilled. The avoidance of infection of the mastoidectomy cavity was aided by the use of a sulfonamide compound and penicillin. In addition to these basic requirements, however, one or more other factors must be taken into consideration to account for the repneumatization of the mastoidectomy cavity and, at the same time, the inhibitory effect on osteogenetic closure. The presence of an intact air-containing middle ear cavity suggests itself as one of these factors.

The results in these cases recall to one's attention the immediate good results obtained by Holmgren in cases of otosclerosis in which he operated in a similar way except that some type of covering was placed over the fistula. He demonstrated hearing for the conversational voice at the usual distance of 10 meters and sometimes at as great a distance as 20, 30 or 40 meters a few hours after the making of a fistula in the horizontal canal by the approach for simple mastoidectomy.

Two essential differences between the technic used by Holmgren and that used in my 2 cases are that in these no foreign substance was introduced and no effort was made to cover the fistula, also that sulfonamide compounds and penicillin were used postoperatively. The location of the fistula may have been a point of difference, but in both technics a microscope was used to aid in its preparation and the heat from the burr in my 2 cases was counteracted by the constant presence of saline solution.

It seems probable that with this method the preservation of an open fistula depends on repneumatization and that this requires a normal

eustachian tube and middle ear and an intact tympanic membrane, also that the mastoidectomy wound be closed and that the cavity heal without infection.

SUMMARY AND CONCLUSIONS

Further observations on factors influencing osteogenesis at the site of the labyrinthine fistula are presented, and the role of the covering flap is considered in particular.

The interpretation based on the previous experiments, that success in maintaining a patent fenestra in a semicircular canal is dependent on the degree to which the membranous canal is preserved in its normal position at the outer periphery of the bony canal, where it is free to come into direct contact with whatever covering may be used over the fistula, appears to be supported.

A factor contributing to the successful application of a covering flap, as previously reported, consists in locating the fistula on the convex surface of the mound formed by the horizontal canal slightly distal to the ampulla. This is provided for in the Lempert nov-ovalis operation.

Several types of covering flap have been utilized in preventing bony closure in monkeys with varying degrees of success: (*a*) A conjunctival graft with epithelium outward was used successfully, but the method is not suitable for clinical use. (*b*) Thiersch grafts were used successfully in several ears. Failure may result from degeneration or from inclusion of hair fragments beneath the graft, which promote callus formation. (*c*) Grafts of the thin skin and periosteum of the bony wall of the external auditory canal proved to be preferable to Thiersch grafts. (*d*) The tympanomeatal pedicle flap used in the Lempert operation was the most successful covering tried in the monkey. This flap avoids the objections that may be made to skin grafts.

Bony closure of a fistula has been prevented in 2 human ears without the application of any covering. In each of these ears the fistula was made, following a complete simple mastoidectomy, without interfering with the drum membrane, the middle ear or the ossicular chain. The mastoidectomy wounds were closed after dusting lightly with sulfathiazole crystals, and penicillin was used postoperatively. A fistula that is apparently permanently open resulted.

In the first case, at reoperation, after about fifteen months, the fistula was found covered by mucoperiosteum. In the second case there has been no reoperation and the fistula remains open after one and one-half years.

From these experiments on animal and human subjects certain conclusions regarding the function of the covering flap seem warranted.

1. The ability to limit osteogenesis is not a characteristic of epidermis only. The same result has been demonstrated with conjunctiva and with mucoperiosteum under suitable conditions.

2. The degree to which either an epidermal flap or graft or a conjunctival graft is effective in preventing osteogenesis between it and the bony surface beneath appears to depend on the maintenance of close apposition. This can be favored by the method of making the fistula but requires also that pressure be used during the early stages of healing.

3. Epidermis is known to cause erosion of bone under conditions in which exfoliation is active and the exfoliated products are not removed (i.e., cholesteatomatous formation of fistula) but the same circumstances do not exist after fenestration. The degree to which a skin flap will be effective in preventing bone formation between it and the underlying bony capsule appears to depend on the maintenance of the closet possible apposition.

4. It appears that the particular value of an epidermal covering consists in the suitability of epidermis as a lining for a radical mastoidectomy cavity, since it provides a dry surface which resists infection and superficial abrasion.

5. Mucoperiosteum is not capable of survival if exposed to the drying effect of the outer air nor can it resist infectious agents.

6. In the human experiment in which no flap was applied it would appear that as blood clot was absorbed the same forces which accounted for the repneumatization of the mastoidectomy cavity contributed to the prevention of osteogenetic closure until the mucoperiosteum had grown across the fistula.

The relative lack of osteogenetic activity of the enchondral layer is a factor which was probably utilized to a greater extent in these two cases than it would have been if a covering flap had been applied, since under these conditions a flap that was not kept in close contact with the bone and also with the outer wall of the membranous canal would probably favor the development of a bridge of bone across the fistula.

DISLOCATION OF THE SEPTAL CARTILAGE

SAMUEL COHEN, M.D.
PHILADELPHIA

THIS condition is observed rather frequently. It may be seen without being accompanied by any marked external nasal manifestation, in cases in which the dislocation is a mild one, but frequently it is accompanied by a distortion of the lower cartilaginous portion of the nose.

NORMAL ANATOMY OF THE SEPTAL CARTILAGE

The posterior border of the septal cartilage rests in a slight groove of the anterior aspect of the vomer. The lower border of the septal cartilage is connected by the septal membrane to the upper border of the columella. The anterior border of the septal cartilage is partly subcutaneous and is flanked on the two sides by the extreme prolongations of the upper lateral cartilages, which may even project under the medial plates of the lower lateral cartilages. These projections are sometimes broken up into small segments (sesamoids).

PATHOLOGIC ANATOMY OF THE DISLOCATED SEPTAL CARTILAGE

Part of the posterior border of the septal cartilage is out of its vomerine groove. The lower border has pulled away the septal membrane from the columella. The upper lateral cartilages are pushed and pulled apart at their lower ends. Last but not least, the pressure and the pulling on the lower lateral cartilages plus the loss of the support of the lower end of the anterior border of the septal cartilage produce distortions of these lower lateral cartilages with resulting visible nasal tip drop and distortion of the nasal tip and nostril.

On examination, the patient shows some of the following conditions: The lower border of the septum is seen protruding into one nostril, anglewise. Sometimes, this protrusion is so marked as to offer complete blockage to air on that side. Only a section of the lower septal border is seen, but by raising the anterior alar margin of that nostril with a retractor and retracting the nostril floor, one may see all of the lower septal border. The lower septal border itself is usually straight, showing no irregularities. I wish to call attention to this point, because when a great force has hit the lower part of the nose and this force has caused

the posterior septal border to be dislocated, some injury of cartilage (e. g., a hematoma, a break) occurs; then the lower septal border becomes irregular. In the usual case, however, one notes no break in the line of the lower septal border. It is simply placed angularly in toto. Therefore, trauma is not the probable etiologic factor in the usual case of septal dislocation. As the body of the displaced piece of septal cartilage is traced in its upward course, a sharp angle or bend is noted. The dislocated strip of cartilage extends up to the vomer (or approximate center of the nasal cavity) and sometimes goes over it into the opposite nasal cavity. If it extends only to the vomer, the balance of the septal cartilage is usually in its normal vomerine relationship. If, however, the strip extends over the vomer into the opposite half of the nasal cavity, the balance of the septal cartilage, on its return, reaches the vomer to produce another angle, and from there the septal cartilage

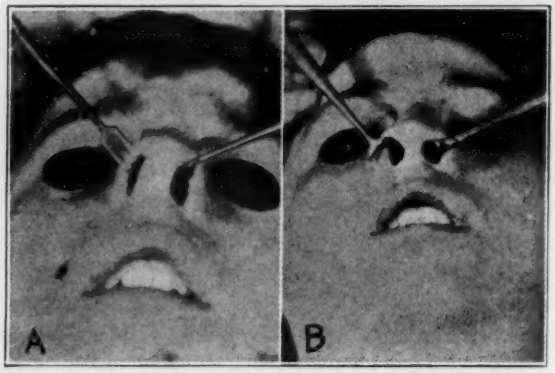


Fig. 1.—*A* shows the lower border of the septal cartilage displaced into the right nostril. The extreme edge of the displaced septal cartilage is fairly straight. Note the almost complete obstruction of the right nostril. This dislocation is probably hereditary; his mother and several other children have displaced septal cartilages.

In *B* the lower part of the septal cartilage has been centralized. The nostrils are not obstructed.

extends up to the perpendicular plate. Thus one notes two or more angles of deflection. On examination the perpendicular plate may also show some unusual irregularity in these cases. These dislocations in which there is double angulation are probably caused by nasal trauma, while those in which there is only one angle of deflection are probably hereditary. (I have seen several families in which one parent and several children had a simple dislocation of the septal cartilage, and no history of nasal injury could be elicited.) This suggests that the simple dislocation of the septal cartilage is hereditary, while the dislocated septal cartilage which shows an irregular lower border and several angles of deflection is traumatic in origin.

On the side of the dislocation the nasal tip is drooping because the lower strip of the septal cartilage, which supports the tip, is minus its vomerine support; it is resting in space and never reaches the floor of the vestibule into which it is dislocated. This also explains the softness of the drooping side of the tip. With this drooping of the nasal tip, a bulge is noted above the tip. This bulge is produced by the anteriormost part of the septal angle of deflection, and may be seen in the nostril of dislocation or in the opposite nostril. A pull is produced by the dislocated piece of cartilage on the other nostril, and that one flattens. Another external nasal bulge may be noted on the opposite side above the opposite nostril. This external bulge is placed higher up. It occurs if the angle of deflection has passed the vomer into the opposite nostril. There are also irregularity and distortion of the nostrils. The nostril into which the dislocation of the septal cartilage has occurred is rounder, while the opposite nostril is elongated and flatter. In addition, the dislocated section of the septal cartilage pulls certain structures with it, such as the septal membrane, so that this membrane is found to be wider than normal (on a stretch). It also pulls the opposite lower cartilage (medial and lateral plates) to the dislocated side, making that nostril angular and flatter. It pushes the lower lateral cartilage of the nostril of dislocation outward. It therefore produces some distortion of that lower lateral cartilage. It pulls the upper lateral cartilages apart, producing a flat appearance of the lower part of the nasal dorsum. The nostrils are different in shape; the nostril into which the cartilage is dislocated is usually wider (from ala to septum) and rounder.

In the section of the nasal dorsum, where normally the lower part of the anterior border of the septal cartilage is subcutaneous and easily palpable, a depression is noted. The narrow slit on each side of the anterior subcutaneous border of the septal cartilage is paralleled by the lower protrusion of the upper lateral cartilage, and is normally filled by dense connective tissues. This space is now distorted. The distortion of this space plus the angular position of the lower strip of the septal cartilage produces the wideness, flatness and depression of the nose just above the tip. The anterior ends of each medial plate of the lower lateral cartilages and the angles of each lower lateral cartilage become wider owing to the pressure of the dislocated cartilage and its pull on the septal membrane. The length of the nose is affected by this dislocation; i. e., it is shorter because of the pull of the septal membrane on the columella. The columella may also be anglewise in position and even retracted. I have gone into the effects of this so-called simple dislocation of the septal cartilage in detail so as to demonstrate that this condition has associated pathologic changes in addition to the twist of the septal cartilage. Cutting the cartilage at its angle, freeing it from

its false vomerine base and replacing it in a groove made on the upper border of the columella will not correct this condition. It also may not stay put.

For a good result, all pathologic changes incident to the septal dislocation must be corrected. Not only must the angle or angles of deflection be corrected, but the relationship between the dislocated section and the upper and lower lateral cartilages must also be adjusted. The connection between the dislocated section and its covering skin must be corrected. In addition, any excess structural changes that may have resulted in time from this abnormal push and pull of the dislocated cartilage may have to be excised, or some addition may have to be made, or some parts adjusted. If the lower lateral cartilages have become distorted and the septal cartilage is simply replaced, this will not markedly alter the distorted nostril; these lower lateral cartilages have to be corrected. The dislocated cartilage exerts a pull on the septal membrane, and therefore on its connected cartilages, which in turn causes distortion or malposition of the columella; therefore the columella may have to be corrected.

The patients usually have no complaints, as most septal dislocations are mild and give little difficulty in breathing. Some, however, complain of difficulty of breathing. Most of them, in addition, complain of the distortion of the lower part of the nose.

CORRRECTION

When a mild dislocation of the septum occurs in an adult, with almost no distortion of the lower part of the nose, and the slight protrusion of the septum which is visible in one nostril is objected to by the patient, the simple procedure of submucously removing a strip of the lower septal border is all that is necessary. No sutures are necessary, although I prefer to place them in. A light vestibular packing is inserted for twenty-four hours.

I will describe two operations for the correction of the more advanced dislocations, the Matzenban, which I believe is almost worthless, and my own technic, which usually gives good results.

Matzenban Operation.—There are nine steps in this procedure, as follows:

1. Incise along the free edge of the lower border of the septal cartilage (cocainization and injections of procaine hydrochloride are necessary preoperatively).

2. Separate the skin and mucosa of the septal cartilage on the convex side to the angle of deflection.

3. Incise the angle of deflection to the opposite perichondrium but not through this, and remove a strip of cartilage of the angle from the top to the vomer.

4. Separate the dislocated cartilage from the vomer and lift the piece of dislocated cartilage, with its opposite skin and perichondrium, from its false bed in the vomer.

5. Scrape the vomer so as to give it a groove on its upper surface.

6. Divide (split) the upper border of the columella by scissors dissection to enable it to receive the dislocated cartilage strip.

7. Replace the septal cartilage strip in this groove in the columella.

8. Place a few sutures connecting the septal mucosa of one side and the skin of the columella on that side to close the first incision.

9. Use a light intranasal packing.

The technic of Matzenban is not based on a thorough consideration of all the pathologic changes in this condition, and therefore it cannot possibly correct all the pathologic changes permanently. Where must the attachments of the septal cartilage be severed before replacement can be successful and permanent? (1) Along the lower medial edges of each upper lateral cartilage to the angles of the lower lateral cartilages; (2) from the skin covering the lower part of the nasal dorsum; (3) from the vomer; (4) from the septal membrane with its one long and one shorter side. The fallacy of the Matzenban operation can be demonstrated by asking how many have made a low, irregular nose straight only by a submucous resection. The Matzenban operation is really a modified submucous resection. To correct this condition, one must attack it with some steps used in the teaching of submucous resection and also some steps learned in rhinoplasty. I find that the Matzenban operation does not correct the pathologic conditions in these cases; therefore it is of value only if the dislocation is a mild one with no real distortion of the lower part of the nose. The Matzenban operation is an incomplete operation.

Rhinoplastic Method of Correcting the Dislocated Septal Cartilage.—There are also nine steps in the procedure now to be described:

1. Free and expose the lower septal border from its anteriormost angle to the anterior nasal spine of the superior maxilla by the regular rhinoplastic technic—that is, by making an intercartilaginous incision, separating the skin over the upper lateral cartilages to the bony piriform margin and then cutting through the septal membrane to the nasal spine, hugging the lower border of the septal cartilage closely.

2. Elevate the septal mucosa and skin on the convex side past the angle of deflection, then go through the cartilage to the opposite perichondrium and elevate the opposite mucosa upward as far as necessary so as to be enabled to remove any more cartilaginous deviations if that is found necessary.

3. Remove submucously the necessary cartilage of the angle and some of the cartilage above it.

4. Cut the upper lateral cartilages from each side of the septal cartilage as far up as necessary with a pair of straight scissors.

5. Lift the strip of dislocated cartilage from where it straddles the vomer and thoroughly free its posterior edge; the strip should be made freely movable.

6. Replace the now freely movable sections of dislocated cartilage into a prepared groove on the upper cut surface of the columella, saving as much of the septal membrane as possible, and sew the septal mucosa to the columella on each side. This can be performed by mucosa to skin sutures on each side, or the all through and through structure sutures.

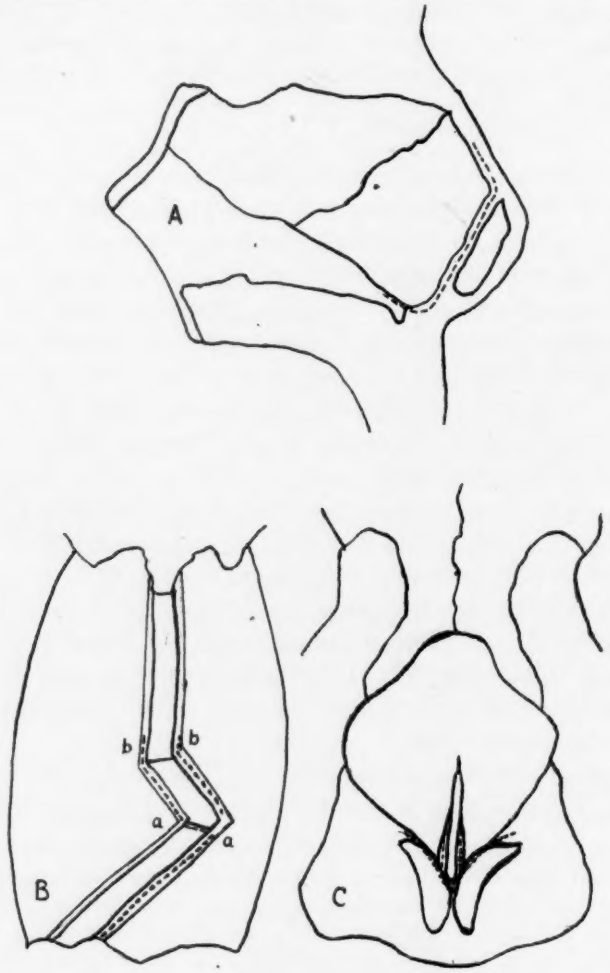


Fig. 2.—The author's operation for dislocated septal cartilage. In *A* the dotted line indicates the separation of the septum from the columella, also part way separation of the skin overlying the anterior septal border and partial separation of the septal cartilage from the vomer.

In *B* the dotted line indicates the incision and the separation of the convex side of the dislocated septal cartilage from its perichondrium to the first angle of deflection; then the cartilage below the angle is cut through to the opposite perichondrium, and that is lifted off; then this part of the cartilage is separated from the opposite perichondrium; then the section of cartilage from *a* to *b* is removed.

In *C* the dotted lines indicate incision along the intercartilaginous lines and incisions cutting the upper lateral cartilages from the septal cartilage.

7. If a section of an upper lateral cartilage is protruding, its removal is indicated, so that it may not later push the septum back again into a dislocation.

8. Examine the lower lateral cartilages and if they need correction, correct them.

9. Use equalized nasal packing. This is best accomplished in my experience with Simpson splints. These are left in for about two days, then changed daily for about ten days. An external nasal dressing, for protection and to ease tension on the sutures, is worn for two days.

As this operation has been performed by me on very young children, a few words on that aspect will not be amiss. One must bear in mind that children's noses have to grow. In children, I don't remove any cartilage unless I am sure of its being absolutely necessary to do so, and then I

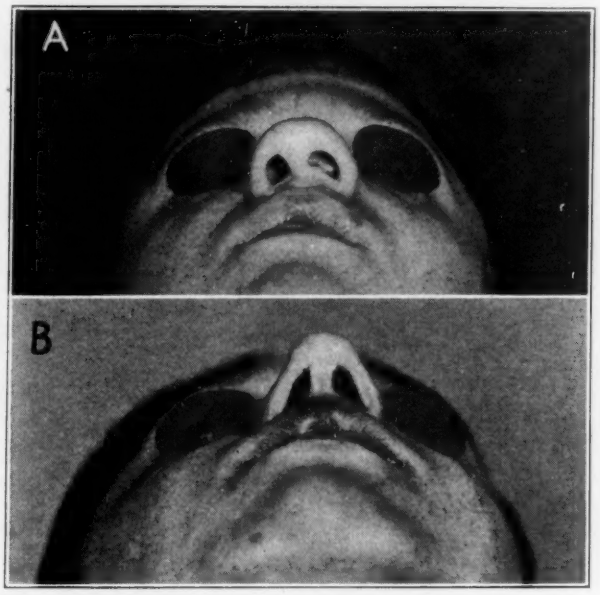


Fig. 3.—Dislocation of the septal cartilage of the nose: *A*, before operation. Note flattening and broadness of the nasal tip. The lower border of the septal cartilage is dislocated into the left nostril, causing almost complete blockage. This septal dislocation is traumatic in origin; note the irregularity of the septal cartilage.

B, after operation. Note that the lower septal border is centralized and that the flattened nasal tip has been replaced by a well shaped tip. The nostrils are now properly shaped and the breathing airway is clear.

remove little. I remove only an anteroposterior sliver of the angle of deflection. A complete submucous resection in children is not advisable. When a section of the upper lateral cartilage protrudes a little, remove only a sliver. In children, the lower lateral cartilages, after the septal cartilage is replaced in its proper position, are not tampered with. In time, these softer cartilages may adjust themselves. The postoperative treatment is the same as for adults.

269 South Nineteenth Street.

CONGENITAL ATRESIA OF THE ESOPHAGUS WITH TRACHEOESOPHAGEAL FISTULA

A Report of Six Cases

JOSEPH A. PERRONE, M.D.

WILLIAM H. FLEMING, M.D.

AND

THEODORE R. WHITAKER, M.D.

PITTSBURGH

CONGENITAL atresia of the esophagus, with or without tracheoesophageal fistula, was until recent years a uniformly fatal anomaly. Leven,[1] in 1941, reported a surgical cure of a patient born Nov. 28, 1939, and Ladd has a living patient who is twenty-four hours younger than the one whose cure was reported by Leven. A total of 464 cases have been counted by us in a review of the literature (including the 6 reported here for the first time), whereas only 37 successful surgical recoveries have been reported. Five writers have presented complete series of cases since 1939. In these series there have been 89 patients and 23 recoveries—a mortality rate of 74 per cent, which is a marked improvement over the 100 per cent rate prior to 1939. According to Mackenzie,[2] this condition was described first in 1670, by Durston, and portrayed again, in a book of anatomy, in 1703, by Thomas Gibson, who observed a case in 1696. Martin [3] published the first case report in 1821.

The embryologic explanation for congenital anomalies of the esophagus is quite obscure. It has been discussed by Singleton and Knight,[4] who stated:

> . . . the normal pulmonary anlage differentiates from the primitive foregut as a tiny, ventrally placed mass of ectoderm . . . just caudal to the pharyngeal pouches . . . so that two lateral longitudinal grooves are formed in the wall of the foregut and their internal elevation is a septum which begins to separate the foregut into a posterior gullet and an anterior trachea.

From the Department of Otolaryngology and Bronchoesophagology, Mercy Hospital.

1. Leven, N. L.: Congenital Atresia of the Esophagus with Tracheoesophageal Fistula, J. Thoracic Surg. **10**:648-657 (Aug.) 1941.

2. Mackenzie, M., cited by Ladd [6] and by Singleton and Knight.[4]

3. Martin, cited by Ladd.[6]

4. Singleton, A. O., and Knight, M. D.: Congenital Atresia of the Esophagus with Tracheoesophageal Fistulae, Ann. Surg. **119**:556-572 (April) 1944.

The exact reason for the interruption or the alteration of growth processes which causes atresia and fistula is unknown.

Esophageal atretic defects have been classified by various authors according to the different forms of atresia and according to whether or not the atresia is combined with fistula. Most authors credited Vogt [5] with the first comprehensive classification, which is as follows:

Type 1. Complete absence or agenesis of esophagus.
Type II. Atresia without fistulas.
Type III. Atresia with fistulas.
(*a*) Fistula between trachea and upper esophageal segment.
(*b*) Fistula between trachea and lower esophageal segment.
(*c*) Fistula between trachea and each of these esophageal segments.

Type III*b* comprises over 80 per cent of all esophageal atretic anomalies seen at autopsies. However, other forms will occasionally be seen and must be kept in mind, since the clinical picture may vary widely, according to the type of anomaly. In type III*b*, the upper blind portion is generally 3 to 4 cm. in length; it is dilated and the muscular wall markedly hypertrophied, producing a structure three or four times the normal size. The distal segment, on the other hand, is generally very thin and atrophic, the diameter frequently measuring only 2 or 3 mm. The fistula occurring between this segment and the trachea is most frequently at or near the bifurcation; less often it is 2 or 3 cm. above this point; only rarely does it enter into a bronchus. The distance between segments is quite variable. In one series, reported by Ladd,[6] the distance varied from overlapping segments to 8 cm.; in the greatest number it varied from 0 to 3 cm. This is an important anatomic variant in that the distance between segments will determine the type of surgical procedure which can be accomplished. Associated congenital anomalies are encountered in as many as 50 per cent of the cases, although Singleton and Knight [4] found only rare instances in which the associated defect was incompatible with life.

A patient with esophageal atresia and tracheoesophageal fistula usually appears normal at birth except, perhaps, for a slight increase in the amount of mucus appearing in the mouth and throat, requiring frequent aspiration. Physical examination may give normal results, or moist rales may be audible in the chest, particularly in the upper lobe of the right lung. The child may appear well until attempts are made to feed it; then there is noticed a difficulty in swallowing, asso-

5. Vogt, E. C.: Congenital Esophageal Atresia, Am. J. Roentgenol. **22**:463-465 (Nov.) 1929.

6. Ladd, W. E.: The Surgical Treatment of Esophageal Atresia and Tracheo-esophageal Fistulas, New England J. Med. **230**:625-637 (May 25) 1944.

ciated with choking, dyspnea and cyanosis. Subsequent observation of the patient will reveal intermittent accumulation of mucus in the mouth and pharynx and an increase of the rales in the chest as continued aspiration of saliva or feedings occurs. The abdomen is frequently distended with gas, although this finding is not constant and depends on the anatomic findings. Air will usually be found in the stomach if a fistula is present between the lower esophageal segment and the trachea, as seen in type III*b*, but in the absence of tracheoesophageal fistula the amount of gas in the stomach will most likely be slight. A combination of these findings should bring to mind the possibility of esophageal atresia and fistula. A more definite diagnosis may be made on an attempt to pass a catheter into the stomach. An obstruction is met at about 10 to 12 cm. from the alveolar margins. If radiopaque material is instilled through the catheter, the diagnosis of atresia can be positively verified by roentgenoscopic examination. Most authors recommend that iodized oil, rather than barium sulfate, be used in this examination, since barium sulfate may cause serious pulmonary complications if it should be permitted to enter the bronchi. It has also been recommended that the iodized oil should be instilled under fluoroscopic guidance, so that only the amount required to make the diagnosis positive need be used, and spilling over into the trachea prevented. Also, the oil may be withdrawn through the catheter after the examination has been completed. If large amounts of air are seen in the stomach on roentgen examination, it usually indicates a tracheoesophageal fistula of type III *b* or *c*. On the other hand, as Haight [7] pointed out, absence of air is suggestive but not necessarily diagnostic of absence of a tracheoesophageal fistula. Occasionally extreme smallness of the fistulous opening may preclude the forcing of air from the respiratory tract into the stomach. Bronchoscopy has been recommended by Shaw [8] as a diagnostic aid, although it has not been uniformly accepted as essential. One may locate the exact site of the fistula by use of the bronchoscope, but it has been pointed out by most writers on the subject that neither a low position of the fistula nor a high level of the upper segment contraindicates surgical investigation, since exploratory thoracotomy is the only definite method of determining the possibility of direct anastomosis of esophageal segments.

The prognosis is uniformly fatal unless some surgical intervention is accomplished which will prevent pneumonia and starvation, the two primary causes of death. Pneumonia is the more pressing problem and is the more difficult to combat.

7. Haight, C.: Congenital Atresia of the Esophagus with Tracheoesophageal Fistula, Ann. Surg. **120**:623-655 (Oct.) 1944.

8. Shaw, R.: Surgical Correction of Congenital Atresia of the Esophagus with Tracheoesophageal Fistula, J. Thoracic Surg. **9**:213-219 (Dec.) 1939.

The bulk of recent literature on the subject is in regard to surgical procedures used to correct the anomaly, some of which have been successful. The objects of any surgical plan are to prevent aspiration pneumonia, to provide some means of feeding and to prevent gastric contents from being regurgitated into the trachea. The surgical plan will in general follow one of two methods, the direct anastomosis of the two segments, or an indirect approach to the problem employing ligation of the tracheoesophageal fistula, exteriorization of the upper esophageal segment and gastrostomy or esophagostomy with subsequent construction of an anterior thoracic skin tube to establish continuity between the esophagus and the stomach. There are several variations of the indirect plan suggested in the literature, which were reviewed by Carter [9] in 1941, when he presented his plan. Most writers have agreed that direct anastomosis is the most desirable method but that occasionally it cannot be carried out because the segments are too widely separated. In one series, reported by Haight,[7] direct anastomosis was possible in 70.8 per cent of cases in which an exploration was performed. Technics for achieving direct anastomosis have been described in detail by Haight,[10] Ladd,[11] Humphreys,[12] Daniel,[13] Singleton and Knight [4] and Gross and Scott.[14] The last-named authors have briefly reviewed these various methods of reconstructing the continuity of the esophagus and have noted five different methods of suturing the two segments. Surgeons have devised various technics in hopes of avoiding such postoperative complications as fistula to the skin, recurrence of the tracheoesophageal fistula or mediastinal leakage with resulting abscess formation. The technical difficulty in making the anastomosis reported by all authors arises from the condition of the lower esophageal segment, which is usually very thin and friable and tears easily. When a direct anastomosis is found to be impossible, the indirect approach to the problem is then used. Ladd [11] stated that from the data at hand to 1944 it seemed that the multistage operation was a considerably safer procedure, though in some ways less desirable.

9. Carter, B. N.: An Operation for the Cure of Congenital Atresia of the Esophagus, Surg., Gynec. & Obst. **73**:485-491 (Oct.) 1941.

10. Haight, C., and Towsley, H. A.: Congenital Atresia of the Esophagus with Tracheoesophageal Fistula, Surg., Gynec. & Obst. **76**:672-688 (June) 1943; footnote 7.

11. Ladd, W. E., in discussion on Haight.[7]

12. Humphreys, G. H.: The Surgical Treatment of Congenital Atresia of the Esophagus, Surgery **15**:801-823 (May) 1944.

13. Daniel, R. A.: Congenital Atresia of the Esophagus with Tracheoesophageal Fistula, Ann. Surg. **120**:764-771 (Nov.) 1944.

14. Gross, R. E., and Scott, H. W., Jr.: Correction of Esophageal Atresia and Tracheoesophageal Fistula by Closure of Fistula and Oblique Anastomosis of Esophageal Segments, Surg., Gynec. & Obst. **82**:518-526 (May) 1946.

However, only 2 cases with completed antethoracic esophagus have been reported, that of Ladd and the one recently reported by Lam.[15] Regardless of the type of surgical correction attempted, the procedure is generally withstood fairly well, despite the magnitude of the operation, if it is done early, before starvation and pneumonia lower the patient's stamina. Postoperative periods are generally quite stormy, frequently accompanied by episodes of cyanosis and dyspnea, high fever and dehydration, and pulmonary complications are the most frequent cause of death.

There are 6 cases of congenital atresia of the esophagus on record at Mercy Hospital, in Pittsburgh. The patients were admitted from 1939 to 1945. A review of these cases follows.

REPORT OF CASES

CASE 1.—N. B., a white girl, was brought to the hospital on May 5, 1939, six days after birth. The birth weight was 4 pounds 2 ounces (1,871 Gm.), the patient being premature. She had regurgitated all feedings and had had an excessive amount of mucus in the nose and throat since birth. A barium sulfate roentgen study had been made at another hospital and a diagnosis of congenital atresia of the esophagus confirmed. On admission the patient was in fairly good condition, the chest clear on physical and on roentgen examination. There was an excessive amount of gas in the abdomen, and a questionable barium sulfate shadow was seen in the abdominal area of the roentgen film. A gastrostomy was done on May 6. The patient continued to have an excessive amount of mucus in the throat after the operation, especially at the time of gastrostomy feeding. On May 8 it was noted that she regurgitated milk after a gastrostomy feeding, the regurgitation being accompanied by cough and cyanosis. At this time coarse rales were heard throughout the chest. These developments continued with subsequent feedings through the gastrostomy tube, with increasing severity, until on May 12 a barium sulfate mixture was introduced through the gastrostomy tube, and under the fluoroscope the barium sulfate was seen to be regurgitated upward through the esophagus, into the trachea at the level of the bifurcation, and into the throat and the nose. The patient progressively became more dyspneic and cyanotic and died, May 12. Autopsy revealed congenital atresia of the esophagus and tracheoesophageal fistula of type IIIb, with a blind proximal segment and a fistula connecting the distal segment with the trachea at the level of the bifurcation. Acute bilateral pneumonia followed aspiration of the barium sulfate suspension, with pleural effusion (100 cc.) on the right.

CASE 2.—J. W., a 4 day old full term white boy, was admitted to the hospital on Oct. 26, 1941, with symptoms of excessive mucus in the throat, regurgitation of all feedings, and fever. Physical examination revealed multiple coarse rales throughout the chest. In view of the history, atresia of the esophagus was suspected. On October 27, a catheter was introduced into the upper part of the esophagus under fluoroscopic guidance, and an obstruction was met at the suprasternal notch. Barium sulfate was introduced through the tube but did not pass

15. Lam, C. R.: Further Experiences in the Surgical Treatment of Congenital Atresia of the Esophagus with Tracheoesophageal Fistula, Surgery **20**:174-179 (Aug.) 1946.

below the suprasternal notch. There was a definite dilatation of the esophagus above this point. A roentgen film of the chest showed haziness of the upper lobe of the right lung, suggesting atelectasis. There was considerable gas in the gastrointestinal tract, but no shadow suggesting barium sulfate either in the abdomen or in the lungs. The child was given fluids rectally and subcutaneously, and a gastrostomy was done on October 29, with the patient under local anesthesia. The child apparently withstood the operation very well. Feedings subsequently given via gastrostomy tube were seen to be expectorated through the mouth. The temperature remained high (106 F.), and thick greenish mucus continuously appeared in the mouth. The respirations became more rapid, and the child became cyanotic despite continuous oxygen therapy, and on October 31 he died. At autopsy the principal findings were congenital atresia of the esophagus, tracheoesophageal fistula connecting with the lower segment of the esophagus, acute bronchopneumonia, small abscess of the lower lobe of the left lung and partial collapse of the lungs.

CASE 3.—W. L., a 10 day old full term white boy, was admitted to the hospital on Oct. 2, 1942 because of regurgitation of feedings, cyanosis and excessive mucus in the throat. The patient was born in another hospital, where a diagnosis of pneumonia and atelectasis of the upper lobe of the right lung was made on roentgen examination. The chest was clear on physical examination at the time of admission to Mercy Hospital, but considerable mucus was aspirated from the throat. Attempts to feed the child resulted in regurgitation of the entire feeding. On October 3 a roentgen film failed to reveal any pathologic changes in the chest. On October 5 the child was given a barium sulfate mixture by mouth, and an obstruction was noted in the esophagus at the level of the suprasternal notch. No barium sulfate passed beyond this point. There was haziness of the upper lobe of the right lung, which was thought to be due to atelectasis. A tracheoesophageal fistula could not be demonstrated by the roentgenologist. The patient was given fluids by vein and subcutaneously, and several plasma transfusions were administered. On October 8 a jejunostomy was done, with the child under local anesthesia, at which time considerable gas was encountered in the entire gastrointestinal tract. Jejunostomy feedings were given postoperatively. The postoperative course was stormy, the infant having a high fever (107 F.), frequent episodes of apnea requiring artificial respirations, and almost constant cyanosis. Green mucus occasionally appeared in the mouth, and aspiration of mucus in the throat was required at frequent intervals. The child showed physical signs of pneumonia on several occasions. His condition continued poor, and he became progressively more lethargic, and died on October 14. Permission for autopsy was not granted.

CASE 4.—G. F., a 3 day old eight month premature white boy, was admitted to the hospital on March 11, 1943 because of inability to swallow, with severe coughing on attempts to nurse. At admission he was markedly dehydrated and jaundiced and had moist rales throughout the chest. Brown mucus was noted in the mouth. All attempts to feed the child by mouth were stopped, and fluids were administered by bowel and subcutaneously. On March 12, 1943 a catheter was introduced into the upper part of the esophagus and iodized oil instilled under fluoroscopic guidance. An obstruction was noticed at the level of the suprasternal notch. No fistula could be demonstrated at this examination. On March 14 a gastrostomy was done, with use of drop ether anesthesia. The child withstood the operation well, and gastrostomy feedings were begun. It was noted that occasionally after a feeding by gastrostomy tube, some of the food could be seen

in the mouth. The condition of the patient remained fairly good until March 15, when he rather suddenly became dyspneic and cyanotic, and died within an hour. Autopsy showed atresia of the esophagus, but no fistula could be demonstrated with any part of the esophagus or the trachea. There were marked emaciation, atelectasis of the lungs and acute peritonitis.

CASE 5.—Infant H. was born at Mercy Hospital on April 1, 1943 and appeared in every respect to be a normal, full term white boy. Nothing unusual was noted until the following day, when a nurse reported that the child had an increased amount of mucus in the throat and was cyanotic. A large amount of thick, tenacious secretion was aspirated from the trachea. An attempt was made to pass a catheter down the esophgus, but the catheter would not pass the suprasternal notch (confirmed by fluoroscopy), and a diagnosis of tracheoesophageal fistula and atresia of the esophagus was made. The patient was given fluids subcutaneously, and oxygen was administered intermittently for cyanosis and dyspnea until April 6, when a gastrostomy was done, drop ether anesthesia being used. The lower end of the esophagus was ligated at the time of gastrostomy. Feedings by gastrostomy tube were begun, and oxygen was administered continuously. The postoperative course was stormy, the temperature remaining high and the respirations labored. The patient became progressively weaker and died on April 8. Autopsy showed congenital atresia of the esophagus with tracheoesophageal fistula involving the distal segment of the esophagus. There were extensive atelectasis of both lungs, an anomalous position of the left kidney and of the sigmoid flexure, and a patent and enlarged foramen ovale.

CASE 6.—Infant M. was born in Mercy Hospital on Aug. 2, 1945 and appeared to be a normal, full term white boy. About four hours after birth the nurse noticed a large amount of mucus in the throat and cyanosis, requiring several aspirations. This was noticed again on August 4. The following day an examination of the chest revealed absence of breath sounds in both apexes and moist rales in the lower lung fields. A roentgenogram of the chest showed partial atelectasis of the upper lobe of the right lung. The temperature then became elevated, and it was noted that the patient did not retain any feedings. Penicillin and subcutaneous fluids were administered, with the temperature returning to normal. On August 7 stenosis or atresia of the gastrointestinal tract was suggested. No feedings were retained until August 10, when mouth feedings were discontinued after a fluoroscopic examination of the esophagus made with use of a barium sulfate mixture showed complete obstruction in the proximal third of the esophagus. Fluids were given by bowel and subcutaneously until August 14, when gastrostomy and transection of the lower end of the esophagus were done with the patient under local anesthesia. After operation the child was given penicillin, oxygen continuously, fluids subcutaneously and gastrostomy feedings. He appeared to be well shortly after the operation, the temperature subsiding to normal within twenty-four hours, and the respirations quiet and easy. However, on the third postoperative day, he became cyanotic, the respirations were shallow, and death followed on August 17, probably due to pneumonia and exhaustion. Permission for autopsy was not granted.

These case histories have been presented primarily to corroborate certain conclusions of most of those who have written on the subject, especially in regard to the various pitfalls most frequently encountered in the management of these patients. As Ladd [11] stated, prior to 1939

little was accomplished in the treatment of this condition and surgeons were more or less groping about trying to devise some method of helping these unfortunate patients. Since 1939, however, experience has taught various do's and don'ts, which have in many instances brought gratifying results. In this series there were four different attending surgeons or pediatricians in charge of the patients, resulting in a lack of experience with successive patients and hence in a duplication of errors of judgment which might not have occurred had one surgeon handled all 6 patients.

The clinical histories presented here are similar. In every instance, the symptom "excessive mucus in the mouth and throat" appeared on the clinical record at some time. There is a remarkably constant symptom complex in these patients, namely choking at feedings, regurgitation of feedings, accumulation of mucus and cyanosis. Too frequently the patient is observed and treated for the pulmonary complications for an extended period and the primary cause of the patient's symptoms is overlooked, as in cases 3 and 6 of this series. Frequently, in view of the regurgitation of feedings, the patient is suspected of having pyloric stenosis, but this confusion should not exist too frequently.

Most authors have urged that the practicing physician and the obstetrician must recognize this condition from the symptoms at an early age if successful surgical correction is to be anticipated. In this series, the diagnosis was definitely established in case 5 within two days after birth; however, operation was postponed several days, and pulmonary complications intervened. In order to have recoveries in these patients, the diagnosis must be established and surgical correction accomplished early to prevent pneumonia and starvation from taking the life of the patient.

An example of the dangers of the use of barium sulfate for diagnostic purposes is seen in case 1, in which death occurred soon after barium sulfate had been permitted to enter the bronchi. Iodized oil should be used in preference to barium sulfate, since complications resulting when oil is instilled into the lungs are much less severe than those resulting when barium sulfate enters these organs.

The first 3 cases of this series show the necessity of an early closing of a fistula connecting the lower esophageal segment with the trachea. In these 3 cases it appears obvious that the gastric contents were constantly being regurgitated upward into the trachea, causing fatal pneumonia. Some aspiration of material from a spilling over of the contents of the upper esophageal segment may also have occurred. Both of these possibilities were recognized in later cases, when the lower part of the esophagus was ligated at the time of gastrostomy and nurses were instructed to aspirate the pharynx at frequent intervals.

SUMMARY AND CONCLUSIONS

Congenital atresia of the esophagus with tracheoesophageal fistula is no longer a hopeless anomaly but rather one which is rapidly becoming more and more amenable to surgical correction, since methods have been devised to prevent early death of the patient.

A remarkably constant symptom complex is present in these cases, which should make the obstetrician or the pediatrician suspect this defect and verify the diagnosis at an early age.

Delay in attempting surgical correction is generally fatal because of complications arising when foreign material is aspirated into the lungs and because of rapid starvation.

Six cases on record at Mercy Hospital have been reviewed, all of which terminated fatally.

CONTACT ULCER OF THE LARYNX

II. The Role of Vocal Reeducation

GEORGIANA PEACHER, Ph.D.
PHILADELPHIA
AND
PAUL HOLINGER, M.D.
CHICAGO

VOCAL abuse has been conceded by laryngologists to be the factor contributing most to contact ulcer of the larynx. If this is true, vocal reeducation should have an effect in the healing of the ulcer. Because of this, it was deemed desirable to study the effect on contact ulcer of training in good vocal production.

THE PROBLEM AND THE METHOD

Sixteen patients with contact ulcer of the larynx were divided into experimental and control groups. Of the 16 patients, 6 were within commuting distance of the speech clinic of Northwestern University and were given a series of lessons by one of us (G. P.) in vocal reeducation. The length of treatment varied from four to nine months, with one or two half-hour sessions a week. This procedure presented to each patient instruction in the correct use of the speaking voice, which is quite dissimilar to training of the singing voice. Although all factors were considered with each patient, individual adaptations were occasionally necessary, such as the length of time spent on any one phase, the amount of repetition, review and elaboration, these variations being dictated by a thorough analysis of vocal quality and of habits of production. Here it must be stressed that only a qualified speech pathologist should treat such patients. For this type of teaching the clinician should have an advanced rating in the American Speech Correction Association.[1]

The remaining 10 patients, who were unable to commute regularly, composed the control group. In both groups the course of the ulcer was traced from the time it was first diagnosed. The types of treatment given and the results obtained were recorded. Differences were drawn between the experimental and the control group with special regard to the voice, the methods of treatment, the symptoms and the course of the ulcer.

1. Further information may be obtained from Dr. Wendell Johnson, Speech Clinic, University of Iowa, Iowa City.

THE RESULTS OBSERVED IN THE EXPERIMENTAL GROUP

All members of the group receiving vocal reeducation showed definite curative signs. The data concerning these patients are shown in table 1. Of the 5 whose ulcers had not been removed surgically before treatment, 3 experienced cure of the ulcers with cessation of symptoms and 2 showed an almost complete return to normal. The remaining member of the experimental group had the ulcer removed just prior to vocal

TABLE 1.—*The Experimental Group*

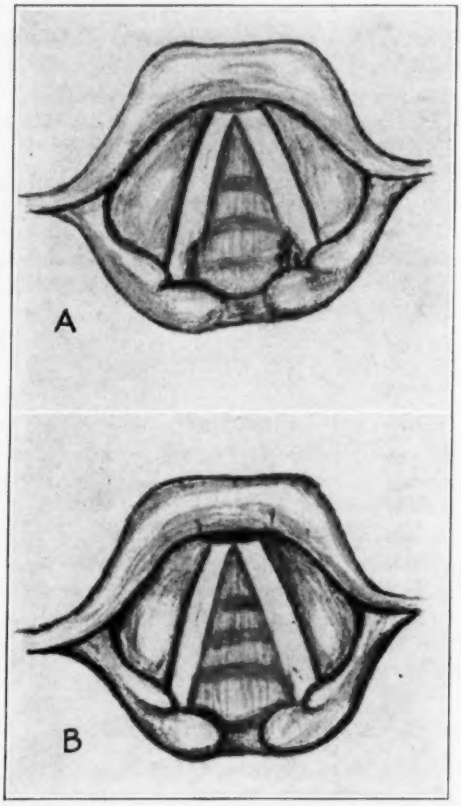
Patient	Age	Treatment	Results
1	41	Surgical excision and silence	Ulcer recurred one month after operation, three weeks after his return to speaking
		3 months' vocal rest	Ulcer did not disappear
		Vocal reeducation	Larynx returned to normal in one month; at the end of eight months' treatment, the ulcer still was unapparent; symptoms desisted
2	52	Vocal reeducation	In four months the granuloma and ulcer resolved, and there was no recrudescence in the following five months of observation; pain and hoarseness ceased
3	69	Vocal rest and retirement from teaching	No change of condition of larynx or of symptoms of severe pain and hoarseness which had been intermittent for seven years and constant for the last three years
		Vocal reeducation	Condition of the larynx returned to normal and all symptoms ceased
4	44	Surgical excision and immediate vocal reeducation	In four months of vocal treatment, the right cord, where the excised ulcer had been, evened out, and the ulcer of the left cord disappeared; all symptoms were arrested
5	42	One month's silence succeeded by reduction of speaking	No change in the laryngeal condition; sharp intermittent pain and ulcer persisted for two years; there was considerable increase in the granuloma during these two years
		Vocal reeducation	After two months the granuloma disappeared; the crater which remained gradually evened out in the course of two additional months; only a small amount of exudate remained; the indentation of the right cord evened out completely; no symptoms were present
6	55	One month's silence	Ulcer increased in size
		Surgical excision and two months' silence	Ulcer recurred and increased in size
		Vocal reeducation	Ulcer gradually decreased in size until at the end of four months only a small amount of exudate remained on one vocal cord; the opposite cord completely evened out; there was resolution of all symptoms

treatment and the ulcer did not recur. In the 2 persons in whom the return to normal was not complete, the granuloma had resolved, the bed of the ulcer had almost healed, and the pain and hoarseness had ceased. This study was terminated at a prearranged date, and these 2 were the last to begin treatment and received lessons for the shortest period. Thus, it can be stated that the condition of the larynx returned to normal in 4 and to almost normal in 2.

Outstanding among the patients of the experimental group was a clergyman (no. 2 in table 1). Over a period of thirty years he had used his voice considerably

in public speaking. He had taught in schools and colleges and, at the same time, carried on his duties as a minister. He strained his voice, especially in preaching. People sitting toward the back of the church and in the balcony always had difficulty in hearing him. When he learned of this, he perforce talked more and more vehemently. The last few months before consulting a laryngologist he was very hoarse and had considerable laryngeal pain in speaking. It was a great effort for him to speak and his voice tired easily. In the accompanying figure, *A* shows the ulcer at first examination.

Vocal reeducation was started immediately, with no period of silence. Two half-hour lessons were given weekly. At the beginning of vocal training the



A, ulcer of the vocal cords. The posterior portion of the left vocal cord shows a marked inflammatory reaction about the mass on the vocal process of the left arytenoid cartilage. The area is red, and there are two small points of white exudate on its surface. A granuloma has formed in the bed of the ulcer on the left vocal process.

B, condition of the vocal cords after four months of vocal reeducation. The granuloma has disappeared, the ulcerated area has resolved and the larynx has returned to a completely normal condition with perfectly evened cords. Four months later, at the end of vocal treatment, examination showed a normal larynx.

average pitch used in speaking by the patient was at G below the bass staff, or an octave and a half below middle C. This pitch was an octave below the

average for the speaking voices of men. His total range of pitch was limited to five full notes from E to B. For the most part, he spoke in a monotonous pitch pattern, with an abrupt fall on the last word or syllable of a phrase, a clause or a sentence. There was, therefore, a repetition of a declining melody. Words were stressed by an expulsive increase of intensity. Great pressure of air was used, and the volume was loud. The voice was extremely and constantly hoarse. In the initiation of tone glottal plosive attacks were frequent. All vocal production was marked by excessive tension.

The principles of good vocal production were presented, and the patient responded exceptionally well. He followed all instructions, practiced regularly and carried good vocal habits into all his speaking. At the end of one month the following laryngeal report was made: "There has been a definite improvement of the patient's larynx. The amount of granulation tissue and swelling on the vocal process of the left arytenoid cartilage has been reduced, and there is no exudate at present as there was on previous examination. The granuloma is softer in appearance. The configuration on the opposite side shows less inflammatory reaction."

The patient's voice gradually improved in quality. Optimum pitch was set at G immediately below middle C, with a range from E of the bass staff to C above middle C. Between these pitches the voice had a clear quality. By this, the pitch of the patient's voice was raised one octave and given a greater range.

Further improvement was noted in the laryngeal condition the next month, and in four months from the date of initiation of vocal reeducation the granuloma and the ulcer had entirely disappeared and the edges of both cords were straight. The larynx had thus returned to a normal condition with no cicatrix, as shown by *B* in the figure.

Gradually the patient was permitted to give more and more sermons and public speeches. All were given with easy production of voice. The members of the audience, formerly in the quagmire of strained listening for imperceptible phrases, now heard with the greatest clarity. During the four additional months of vocal training the patient resumed preaching twice on Sundays and his daily teaching. The ulcer did not recur during this time, nor during the two years which followed. Projection of the voice was increased, keeping the ease of production. A greater range was attained over the octave range set at the beginning of treatment. The voice became clear and resonant in quality, flexible in range, controlled and free from fatigue, discomfort and strain.

RESULTS OBSERVED IN THE CONTROL GROUP

Table 2 gives account of those patients not receiving vocal reeducation. Of these 10 patients, 2 showed cure of the ulcer after undergoing surgical treatment or a long period of vocal silence, or both, followed by reduction of the amount and the forcefulness of their speech. Six others of the 10 suffered continuance of symptoms and ulcer even after surgical treatment or silence. Another had recurrence of the ulcer after two operations, and it finally disappeared only after several months of complete silence. There was no follow-up after his coming off silence to show the subsequent condition of the larynx. The tenth patient was seen only once, and therefore the ensuing laryngeal status is not known.

An example of the patients included in the control group is one (no. 2) who demonstrated in effect the opposite of that seen in the experimental group. This 47 year old merchant received a diagnosis of contact ulcer in the fall of 1937. He remained on silence for a year, during which time he vacationed in Texas. In February 1943 examination revealed that the ulcer was still present. His voice was as hoarse as it had been previously. He never smoked or used alcoholic beverages. Mirror laryngoscopy showed the cords to be more irregular than before. On Feb. 9, 1944 he was reexamined. A marked cough and dyspnea had developed. The latter was associated with pain of the precordal region. The ulcer was still present.

TABLE 2.—*The Control Group*

Patient	Age	Treatment	Results
1	60	One month's silence	Ulcer and symptoms persisted
2	47	One year's silence and vacation in dry climate	Ulcer and pain and hoarseness endured for seven years after first diagnosis
3	50	Silence and reduction of speaking	Ulcer and symptoms still persisted four years after first diagnosis
4	63	Three months' silence followed by great reduction of amount and vigor of speech	Ulcer resolved after seven months
5	66	Whispering	Symptoms became more severe
		Silence	Ulcer continued
		Surgical excision and silence	Ulcer recurred
		Surgical excision and silence	Ulcer recurred again
		Seven months' unbroken silence	Ulcer disappeared, but patient was not seen again to check his condition after his resumption of speech
6	50	Surgical excision, two months' silence and great reduction of speech	Nine months after surgical excision the larynx returned to normal condition
7	61	No treatment	Patient was not seen again
8	27	Surgical excision and silence	Ulcer recurred
		One month's silence	Ulcer remains two years after diagnosis
9	27	One month's silence	Slight improvement immediately after period of silence, but then laryngeal condition and symptoms became more severe; ulcer has now persisted for two years
10	45	Surgical excision	Ulcer recurred
		Surgical excision one year later	Ulcer recurred

A year later, on March 1, 1945, laryngoscopy showed persistence of the ulcer. There had been increases in the hoarseness at various intervals. This had been associated with occasional hemoptysis. At this examination the following notation was made in regard to the patient's voice: "Habitual pitch was very low in the bass staff. The pitch range was limited, covering only a few notes. The melody pattern was confined. Almost no inflections were noted. It was a small, rigid melody. The intensity of the voice was great. Throughout there was forceful breath expulsion. A stress pattern was not detected, but rather a continuous forcefulness on every syllable and every word. Extreme amounts of breath pressure were used. Breaths were deep, but were expelled so lustily that they were of short duration. Accompanying the strength of expirations was a great escapage of breath. The rate of speech tended to be fast and carried a suggestion of excitement. There were few pauses as he spoke. Laryngeal and general bodily tension were extreme during all phonations as well as during

vocal rest. The quality of the voice might be described as throaty, raspy and breathy. The patient's voice became very tired after an hour's talking. His throat became more sore. His voice was weaker with increased breathiness, but he continued to force it."

This laryngeal condition had been present since 1937. Thus, the case was one in which vocal abuse had perpetuated the symptoms and the condition of contact ulcer for a period of eight years.

COMPARISON OF THE EXPERIMENTAL AND CONTROL GROUPS

The patients in both the experimental and the control group demonstrated a common fact: the fact that the ulcer did not heal unless the patient changed his method of production in the direction of easier and more relaxed phonation. Two patients in the control group who greatly reduced the amount of speaking had cessation of the ulcer. There were many, however, who did likewise and had continuance of the condition. All receiving vocal reeducation showed cessation of symptoms with total or nearly complete disappearance of the ulcer.

Hence it was seen that for the most part the ulcer heals after careful vocal reeducation, or after surgical treatment only, or after surgical treatment and silence plus considerable reduction of the amount and the vigor of speaking. The period of vocal reeducation was shorter than that required for relief in the control group. The ulcers in the experimental group which disappeared took from one to four months and did not recur during the latter months of treatment. Those which disappeared among the patients of the control group after surgical treatment and silence required seven months to three years. Silence was not a part of the vocal treatment. This affords the patient much relief, as all patients object to complete silence. It is contended that if the patient uses his voice correctly, the amount of talking need not make a difference. In the program of vocal reeducation followed in this study, the patients were instructed to use their voices as much as they desired at and away from work but always to remember the correct manner of using their voices. From the beginning of this treatment, no patient was told to limit the amount of speech. One patient only was restricted from speaking before large groups until the time came when he could project his voice without the previous strain and effort. Obviously, it is better to institute vocal reeducation than simply to recommend a long period of silence followed by a reduction of the amount and the vigor of speaking.

One advantage of vocal training is that the patient will learn the correct methods and control of vocal production and will be less likely to slip back into former habits of vocal abuse than patients who have not received such training. They will learn how to achieve optimum pitch and easy initiation of tone, which they could not learn by themselves.

The fact remains that in the control group several patients continued using their voices incorrectly and had perpetuation of their ulcers and symptoms. It is absolutely necessary, therefore, that the patient with contact ulcer radically alter his method of phonation.

All patients of both groups had at the time of and prior to the diagnosis of contact ulcer a characteristic type of phonation which, in all probability, was a predominant etiologic factor. There were individual variations and degrees of vocal abuse, but all had the following general deviations from good vocal production:

1. Extreme tension of the speech musculature, as well as generalized bodily tension
2. Forcing of the pitch far below the optimum
3. Glottal plosive attack
4. Explosive speech
   (*a*) Predominant stress pattern
   (*b*) Rigid melody or confined pitch range
   (*c*) Considerable breath pressure
   (*d*) Loud intensity
5. Hoarse quality

The following conclusions were drawn:

1. Vocal abuse seemed to be the most consistent etiologic factor of contact ulcer of the larynx in these patients.
2. Vocal abuse seemed to be the chief perpetuating factor of contact ulcer in these patients.
3. Contact ulcer was treated by vocal reeducation with apparently better results than can be obtained by surgical excision of the ulcer and silence.

EFFECT OF A TYPICAL NASAL PLASTIC CORRECTION ON FACIAL EXPRESSION

BRUNO L. GRIESMAN, M.D.
NEW YORK

IT WAS Joseph [1] who first described the surprising alteration of facial expression after treatment according to the principles of nasal plastic surgery. He depicted the subjects of plastic surgery dancing in a happy mood, and it was his belief that the newly acquired state of satisfaction was mainly psychologic, due to the absence of the previous nasal disfigurement.

Some of my patients who were treated by nasal plastic surgery without anything else showed such a remarkable spontaneous improvement in their entire countenance that the question could be asked whether this change of facial expression was actually caused only by psychologic uplift. Or is it possible that nasal surgery alone can effect indirectly changes of facial expression?

To answer this question, I undertook the following study.

Figure 1 shows the same patient before and after nasal repair. The second picture was taken seven weeks after the first.

The preoperative diagnosis was: congenital nasal deformity; nasal hump, with the nose projecting from the face at an angle of 42 degrees; elongated nose; nasolabial angle of 90 degrees; bony vault and upper and lower cartilaginous vault too wide; bulbous tip; flaring nostrils; nasolabial web; base of columella too wide; short upper lip; receding chin.

A reconstruction of the nose was carried out as follows: The nose was anesthetized and packed posteriorly. The soft tissue over the nasal framework was elevated through intranasal intercartilaginous incisions. The nose was transfixed, and the membranous septum was cut through to the anterior nasal spine. A saw was engaged along the base of the hump and the bone sawed through. The cartilaginous portion of the hump was resected with a button end knife. The hump was extracted. The upper lateral cartilages were cut from the septum. A triangle with its base on the dorsum and its apex at the anterior nasal spine was excised from the caudal end of the septal cartilage. The excess portion of the inferior nasal spine of the maxilla was excised by chisel. Incisions were made on both sides through the mucosa down to the bone of the lateral margin of the piriform aperture. The periosteum was elevated along the nasofacial groove toward the

From the Department of Otolaryngology, Presbyterian Hospital and Vanderbilt Clinic, Columbia University College of Physicians and Surgeons.

1. Joseph, J.: Nasenplastik und sonstige Gesichtsplastik, Leipzig, Curt Kabitzsch, 1931.

inner canthus. The bone was sawed partially through on both sides. The solid block of the nasal bone was cut through with chisel on both sides near the perpendicular plate of the ethmoid bone. The fractures were completed by digital pressure. The bones were brought to the midline. The lower lateral cartilages, together with the underlying covering, were delivered through the marginal incisions and bisected on a line just medial to the angles. The lateral and mesial crura were reduced by removal of strips from the cut margins. The columella was attached to the septum at a higher level with two heavy silk sutures. The projecting portions of the upper lateral cartilages were resected. The base of the columella was narrowed by subcutaneous removal of connective tissue. A button of cartilage was transplanted into the tip of the nose. The posterior nasal packs were withdrawn. A full thickness triangular piece was excised from the basal attachment of each ala with the apex toward the cheek and the base toward the nostril. The alae were separated along the nasofacial groove. The flaring nostrils were

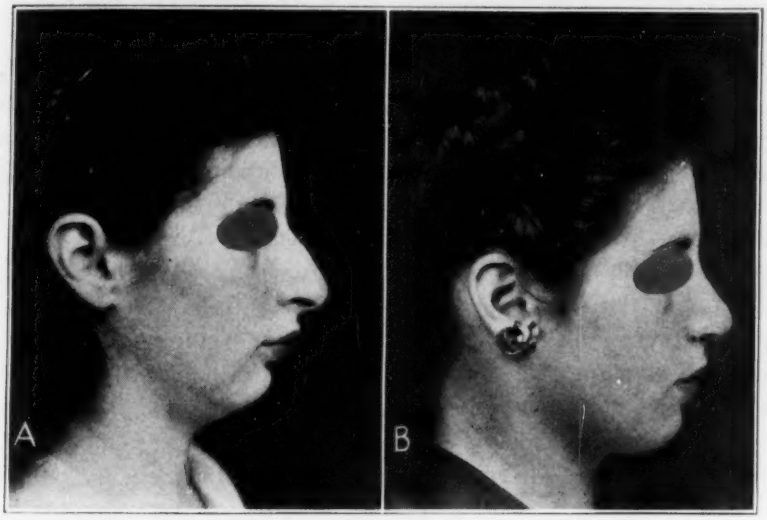


Fig. 1.—*A*, appearance before plastic correction. Note the relationship between the elongation of the nose and the distortion of the lower part of the face. Note also the bending of the upper lip and the acute angle of the lower lip and chin. *B*, harmonious effect of the plastic correction. Shortening the nose has restored the regularity of the lower part of the face. Note the difference in the angle of the lower lip and chin.

swung in. The wounds were closed by atraumatic sutures. A subcutaneous submerged nasolabial suture formed the desired nasolabial angle and fulfilled the intention of lengthening the upper lip. The anterior nares were packed with petrolatum gauze. A stent dressing was applied.

On comparing the two photographs of the patient (fig. 1 *A* and *B*) one will notice several apparent changes. *B* shows the new profile line, the increase of the nasolabial angle and the change of direction of the nostrils. The nasofacial groove, no longer convex toward the nasolabial fold, runs more vertically except at its caudal end, which describes a slight curve. The upper lip seems elongated and has lost its concavity.

Besides this, however, the area around the lower lip and the chin and the mentolabial furrow show evidence of straightening and raising.

The foregoing analysis shows that a typical rhinoplasty (i.e., resection of the hump, shortening of the nose, raising of the nasal tip, narrowing of the nasal bridge, modeling of the lower lateral cartilages, shortening of the flaring nostrils and reconstruction of the columella) has a marked influence on an area caudal from the nose around the mouth, the lower lip and the receding chin. This surprising after-effect in facial expression was achieved by performing only a cosmetic reconstruction of the nose, without any operative procedure on the part caudal from the nose, particularly on the contour of the chin.

What are the mechanical connections between the middle and the lower part of the face in facial expression? Are the two independent of each other, or what is their interrelation?

The shape and the structure of any skeletal muscle from its origin to its insertion can be pointed out by anatomic preparation in full plastic beauty. However, when skin and connective tissue are removed from the face, the mimetic musculature produces a grimace. The mimetic musculature in the living, like all the other skeletal muscles, is kept in a state of tonus, ready to contract.

One usually overestimates the importance of the delicate mimetic muscles for the production of the fine alterations of facial expression and one neglects the mechanical quality of the connective tissue, which is under constant stress during the increased tonus of the muscles.

The first objective and scientific study of facial expression seems to have been published by Bell.[2]

Bell's anatomic diagram shows the facial muscles in a state of apparent lack of tonus. Obviously, the musculature appears in a condition of complete relaxation. Darwin[3] pointed to Henle's[4] anatomic drawings as the best ever published to his time and expressed the opinion that the muscles hardly appear on a dissected face so distinct as they are there represented.

Compared with the relaxed appearance of Bell's musculature, Henle's diagram shows the muscles in a strange condition of contraction, of increased tonus.

But both authors fail to mention any particular connective tissue formation associated with facial expression.

---

2. Bell, C.: The Anatomy and Philosophy of Expression, as Connected with the Fine Arts, ed. 5, London, Henry G. Bohn, 1865.

3. Darwin, C.: The Expression of the Emotions in Man and Animals, New York, D. Appleton and Company, 1873.

4. Henle, F.: Handbuch der systematischen Anatomie des Menschen, Braunschweig, F. Vieweg u. Sohn, 1858, vol. 1, p. 3.

It was Hans Virchow [5] who first recognized that facial expression is a combination of the concurrent action of muscles, skin and fat and last, not least, the micromechanics of connective and elastic tissue.

Individual muscle variations, differences in thickness of the cutis and subcutaneous tissue, and differences in the elasticity of the skin have a modifying influence on the working mechanism of facial expression.

There are, according to Virchow, three little fat cushions of importance: (1) one at the side of the root of the nose next to the lateral border of the procerus muscle where skin and bone are in contact, (2) one behind the middle of the upper lip where the lip attaches to the columella, and (3) one back of the middle of the upper edge of the chin.

In the living face the various degrees of thickness of the connective tissue underlying the skin determine the relationship of the skin to the underlying muscles, cartilages and bones.

The skin is firmly held together with the tissues at the area of the chin, and at the lower cartilaginous vault the connective tissue is so tight that it becomes difficult to separate the cutis from the subcutis. At the nasal tip the skin appears almost adherent to the cartilages.

Especially tight appears the connective tissue at the point where the upper lip passes over into the columella. Here it seems almost impossible to obtain knowledge of the direction of the muscle fibers.

In those parts of the skin of the face which are especially concerned in facial expression, there is an accumulation of powerful elastic fibers below the epidermis. Schiefferdecker [6] gave this tight, strong elastic net a distinctive name: "elastica mimica." It effects a uniform tension of the skin, just like a thin plate of rubber.

THE NASOLABIAL FOLD

The repeated contractions of the muscles engrave permanent wrinkles in the skin which produce in the adult face the telltale furrows disclosing the person's moral and emotional nature. In contrast to these furrows there are folds of the skin which are present from early childhood and are attributable to the structures of the underlying tissues.

---

5. Virchow, H.: Gesichtsmuskeln und Gesichtsausdruck, Arch. f. Anat. u. Entwcklngsgesch., 1908, p. 436.

6. Schiefferdecker, P.: Der histologische und mikroskopisch-topographische Bau der Wangenhaut des Menschen, Arch. f. Anat. u. Entwcklngsgesch., 1913, p. 191; Ueber das Auftreten der elastischen Fasern in der Tierreihe, über das Verhalten derselben in der Wangenhaut bei verschiedenen Menschenrassen und über Bindegewebe und Sprache, Arch. f. mikr. Anat. **95**:134, 1921.

One of these structural folds is the nasolabial fold. It is a constant genuine formation, a line of demarcation existing in a more or less marked degree in every subject. The changes in form of the nasolabial fold constitute one of the main factors of facial expression and tell more about the soul and mind than the changes of other facial structures.

The nasolabial fold is produced by the shifting and flexing of two adjacent parts of skin of distinct texture.

The skin of the area around the mouth is tight, without fatty deposits in the subcutaneous tissue, and sticks fast to the underlying muscle fibers.

The skin of the cheek, however, contains an accumulation of subcutaneous fat and elastic fibers and can be easily expanded like a rubber ball. Through muscular action at the boundary line, the tight skin around the mouth and the lower cartilaginous vault is shifted toward the soft, fatty and elastic skin of the cheek and pushes it toward its bony attachment. By this movement the nasolabial fold comes into existence. The course of the fold depends on the activity of the inserted muscles. One can frequently conclude from the form of the fold what special group of muscles is employed.

The nasolabial fold arises cranially from the region above the alar-facial junction, passes obliquely and caudally at a short distance from the dorsal border of the nasal wing to a point located about 1 cm. laterally from the corner of the mouth.

The ala nasi as a part of the lower cartilaginous vault has as its boundary line the alar facial groove. This groove divides the ala from the cheek and from the upper cartilaginous vault.

The nasolabial fold comes into the proximity of the alar-facial groove near the latter's ventral end; but from there it runs separately at an increasing triangular distance and closely parallels the underlying muscle fibers of the pars transversa musculi nasalis.

There are two opposing groups of muscles which seem separated by a boundary line representing the nasolabial sulcus below the surface of the skin. In this landmark the orbicularis system of the eye and the orbicularis system of the mouth come into close relationship in the course of evolutionary development. So it seems that the nasolabial fold represents a real boundary line, a kind of watershed between two distinct muscle groups.

Virchow describes six superficial portions of muscle fibers which act together in elevating the alae nasi and the nasolabial fold. He used the designation "muscles of the nasolabial fold." This group consists of superficial portions, deflected fibers from the pars transversa musculi nasalis, caput angulare, caput infraorbitale and caput zygomaticum quadrati labii superioris (fig. 2).

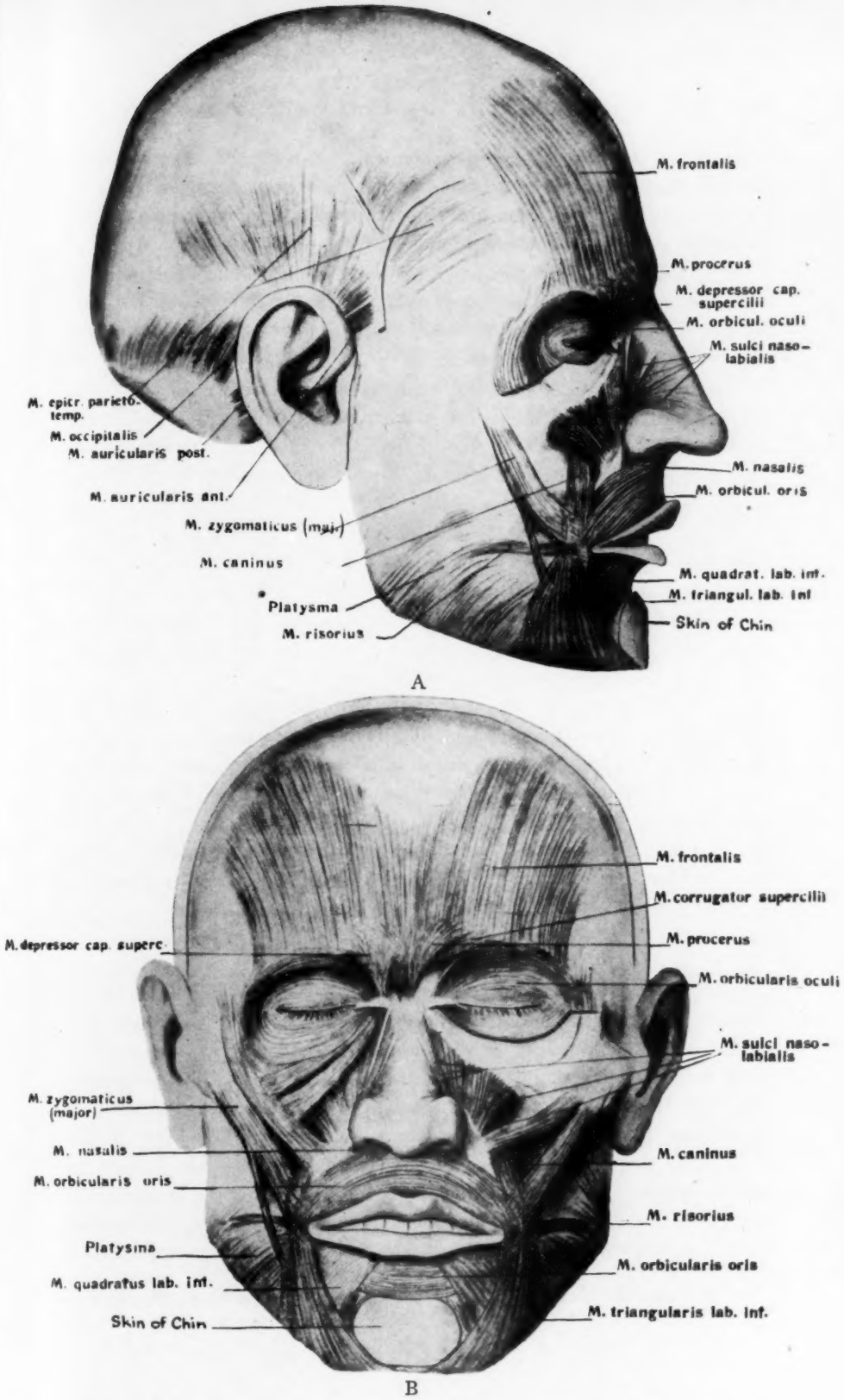


Fig. 2.—Muscles of the nasolabial fold (M. sulci nasolabialis). *A*, facial muscles after Hans Virchow.[5] *B*, facial muscles after Hans Virchow, continued.

It is well known that the deeply running fibers of most of these muscles insert into different parts of the face; for example, fibers of the caput infraorbitale musculi quadrati labii superioris reach out as far as the skin of the lower lip.

It is a moot question whether the muscle fibers find their end in, and insert directly into, the nasolabial fold or whether they continue, through fine tendinous connections, into an inseparable conglomerate of coherent tissue of the upper lip.

Undoubtedly, the functional value is such as it would be if the muscles actually found their end in the nasolabial fold. It is clear that the upper lip will be raised when the muscles raise the nasolabial fold. Therefore, the elevation of the upper lip can be considered as the consequence of traction on the nasolabial fold.

By entering the nasolabial fold the superficial muscle fibers give up their individual character. Beyond this fold there is a region of a collective mass of tissues arising by coalescence of all structures.

It appears feasible to divide the nasolabial fold into three portions: (1) a ventral part, attached to the ala nasi, (2) a dorsal part near the area about the mouth and (3) a middle part.

In certain cases only the ventral and dorsal thirds of the sulcus are occupied by muscle fibers. The middle part remains free. In other cases the entire length of the sulcus is taken up by musculature. This is one of the reasons why the power of raising the wings of the nostrils is individually so variable.

Moreover, the amount and the extent of inserting muscle tissue explain why the appearance of the nasolabial fold varies individually so much and is hardly alike in half a dozen subjects.

THE "FIGURE OF 8"

The pars transversa musculi nasalis forms with its fellow from the opposite side a sling across the upper lateral cartilages. Through this mechanism it compresses the vestibulum nasi and narrows the internal nasal orifice (Zuckerkandl [7]), and draws the lower cartilaginous vault caudally. Both partners are connected by a tendinous sheet which may be compared to the galea aponeurotica covering the convexity of the skull. This thin aponeurosis adheres more tightly to the skin than to the perichondrium. Its cranial extension covers occasionally a small caudal portion of the nasal bones. It represents muscle tissue which became tendinous during the evolutionary development. In the case of the

7. Zuckerkandl, E.: Normale und pathologische Anatomie der Nasenhoehle und ihrer pneumatischen Anhange, ed. 2, Vienna, W. Braumueller, 1893.

Australian aboriginal (Burkitt and Lightoller [8]) the entire pars transversa is yet a powerful muscle sphincter, necessary to compress the wide-flaring nostrils. The pars transversa and the pars alaris of the musculus nasalis are still frequently found in broad primitive connection with the musculus caninus—musculus orbicularis oris (Huber [9]).

There is, however, a second muscular ring stretching out from the upper lip and encircling the chin. The fibers of this sling are made up by the musculus triangularis, which originates from the mandible and from its tight attachment at the skin of the chin and extends through the muscular node at the angle of the mouth, fleshy or tendinous, into the upper lip and its skin. By this arrangement the skin of the upper lip and the skin of the chin are joined together.

The musculus triangularis encircles the commissure of the lips, while in the median plane of the upper lip the bundles of the musculus orbicularis oris closely interlace with those of the opposite muscle and in part pass over to the other side without interruption.

There are frequently below the chin muscle fibers which connect both trangularis muscles—the so-called musculus transversus menti. In spite of the fact that the musculus triangularis alone through its tightly fusing adherence to the mental skin forms the shape of a subcutaneous ring around the chin, it seems obvious that the muscle bundles of the musculus transversus menti reenforce the encircling of the upper lip and chin. The musculus transversus menti is a progressive formation and varies a great deal.

The constructive plan of the muscular mechanism of the area about the mouth appears based on the principle of two synergetic muscular rings. They are designed in the form of the figure of 8 with a smaller nasal circle and a larger ring surrounding the chin. The common base of both rings is the tightly blended upper lip. From there extends cephalad the circle of the musculus nasalis, with its aponeurosis tightly attached to the skin of the nose, and caudad the triangularis-mentalis ring, just as tightly fixed to the skin of the chin (fig. 3).

The corners of the mouth are suspended in this system of circles whereby they can be raised or lowered accordingly.

In this way it is easy to understand that these extensive connections make possible manifold synergetic muscle actions and changes in the degree of projection of the outline from the nose to the chin.

During their phylogenetic development fibers of the musculus nasalis and the musculus triangularis have gained the use of a bony attachment

8. Burkitt, A. N., and Lightoller, G. H.: The Facial Musculature of the Australian Aboriginal, J. Anat. (pt. 1) **61**:14, 1926-1927; (pt. 2) **62**:33, 1927-1928.

9. Huber, E.: Evolution of Facial Musculature and Facial Expression, Baltimore, Johns Hopkins Press, 1931, p. 65.

whereby they are able to exert more vigorous action. The musculus nasalis, for example, by drawing the lower cartilaginous vault caudally with great physical power changes the course of the nasolabial fold. It is noteworthy that this intimate connection of the triangular muscle with the skin of the chin is considered specifically human.

As far as facial expression is concerned, the orbicularis oris group with all its differentiations—the musculus nasalis, the musculus caninus, the caput infraorbitale musculi quadrati labii superioris, the musculus triangularis and the musculus transversus menti—forms a functional unity and can act in concert. From this point of view one may even understand why the caput infraorbitale musculi quadrati labii superioris as a derivative of the orbicularis oris group joins the company of the

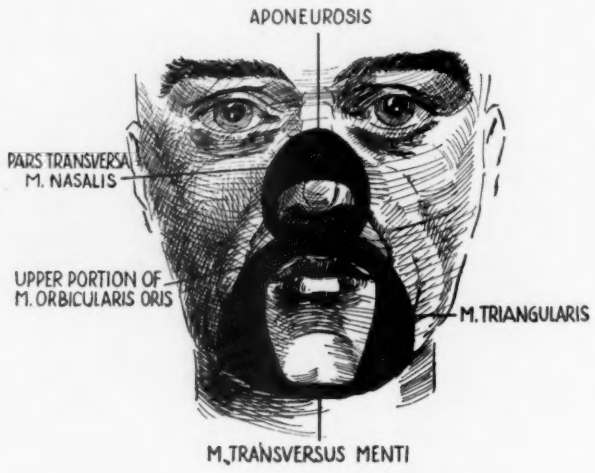


Fig. 3.—The figure of 8.

genetically different group of derivatives of the orbicularis oculi muscles. Its fibers insert as well into the nasolabial fold as into the skin of the lower lip.

THE DISTORTION OF THE LOWER PART OF THE FACE

The following muscular slings can be traced in the area around the mouth (fig. 4):

(1) the musculus orbicularis oris ring,

(2) the outline of the figure of 8 consisting of

(*a*) the nasal ring

(*b*) the upper lip—musculi triangulares chin ring,

(3) the musculi canini–musculi triangulares–muculus transversus menti sling,

(4) the capita infraorbitales—lower lip sling.

With the exception of the musculus orbicularis ring, all the other circles or slings have some kind of bony attachment.

The musculus caninus has its origin in the canine fossa, enters the muscular node at the corner of the mouth, inserts into the skin and the mucosa and has tendinous connections with the musculus orbicularis oris and the musculus triangularis.

One can imagine that effects of muscle actions may be possible whereby the two canini and the two triangulares, occasionally together with the musculus transversus menti, present a continuous muscular sling from maxilla to maxilla around the chin.

The caput infraorbitale musculi quadrati labii superioris arises just below the inferior border of the orbit in an extent of almost 18 mm.

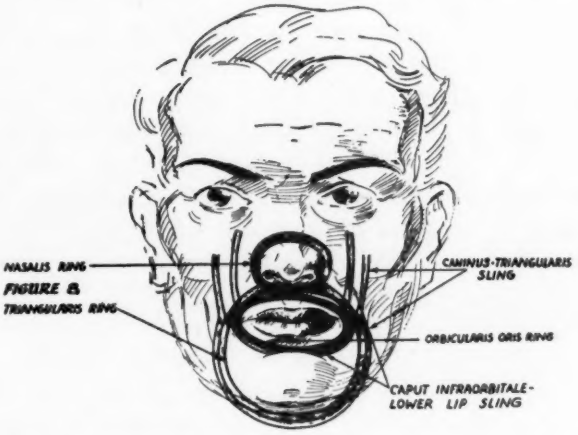


Fig. 4.—Pathways of muscular transmission. The four ways of muscular transmission are: (1) the musculus orbicularis oris ring; (2) the "figure of 8"; (3) the sling of the musculi canini, musculi triangulares and musculus transversus menti; (4) the capita infraorbitales musculi quadrati labii superioris–lower lip sling.

and inserts into the medial third of the nasolabial fold. Some of its fibers stretch out as far as to the skin of the lower lip.

The combined structures of the soft parts of the lower half of the face need room for their expansion. As an elongated nose requires more space than a small nose, it can extend only at the cost of the surface of the region about the mouth. However, there is a limitation to the displacement of the lower part of the face through its bone attachments.

The consequence of this dislocation is the bending and the compression of the upper and the lower lip, clearly visible in figure 1*A*.

THE JUNCTION OF THE LOWER CARTILAGINOUS VAULT AND THE UPPER LIP

The musculus orbicularis oris consists of an upper lip and a lower lip portion. Bundles of both parts insert into a small tendinous field at the angle of the mouth (Braus [10]). This is one of the reasons why the upper and the lower lip can be moved independently.

The cranial border of the upper lip portion of the musculus orbicularis oris approaches laterally the nasolabial fold. But near the nose the two structures separate from each other so that a small triangular field remains between them and the nasofacial groove. This triangle is filled out with fibers of the nasalis muscle and tendinous connections of the musculus quadrati labii superioris which extend in the upper lip between the skin and the musculus orbicularis oris.

The cranial border of the musculus orbicularis oris is tightly fixed to the skin of the upper lip. This union is absolutely firm. Because the same tough skin continues into the skin of the alae nasi, there is indirectly a fixation of the musculus orbicularis oris to the ala nasi.

However, the muscle itself is not directly attached to the ala nasi. There is a small distance between its cranial border and the ala nasi.

The extremely compact connective tissue of the upper lip consolidates still more at the point of the dorsal attachment of the columella. Here it is nearly impossible to identify the direction of the fibers of the muscles.

This tight connective tissue unites intimately the musculus orbicularis oris with the fibers of the musculus nasalis and envelops both.

From the point of view of plastic surgery the relationship of the cranial border of the musculus orbicularis oris and the columella is of special interest.

The cranial fibers of the musculus orbicularis oris ascend toward the medial line. These fibers are called musculus depressor septi nasi (Griesman [11]). In contrast, the columella projects caudally below the level of the alae nasi. Therefore the most cephalic fibers of the musculus orbicularis oris extend above the nasolabial angle. This fact implies that the orbicularis oris fibers have invaded the region of the septum mobile. It is significant that the most cephalic fibers of the musculus orbicularis oris pass like threads through the dorsal attachment of the columella.

Through this anatomic arrangement the musculus orbicularis oris and the columella are intimately connected.

---

10. Braus, H.: Anatomie des Menschen: Ein Lehrbuch für Studierende und Aerzte, Berlin, Julius Springer, 1921, vol. 1, p. 770.

11. Griesman, B.: Muscles and Cartilages of the Nose from the Standpoint of a Typical Rhinoplasty, Arch. Otolaryng. **39**:334 (April) 1944.

This connection of the columella and the alae nasi with the musculus orbicularis oris yields clear evidence that an alternating influence can be exerted from the ala or the columella to the corners of the mouth and even farther to the chin.

It may be assumed that the skin of the nose and the skin of the chin are linked together.

Moreover, this anatomic relationship gives an explanation of the movements of the columella. Besides, through the tightness of the subcutaneous tissue, the septum mobile is entangled in the cranial fibers of the musculus orbicularis oris. If the upper lip is shifted forward or downward, it exerts traction on the columella. This may be one of the reasons for the much complained of postoperative dropping of the nasal tip. The repeated downward stretching of the upper lip during speaking or eating draws the tip caudally, especially if the skin of the face has lost part of its elasticity.

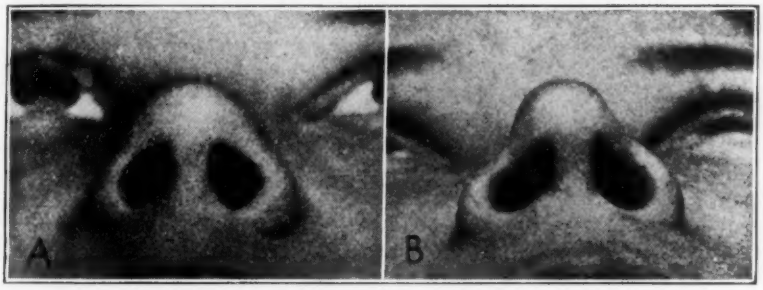


Fig. 5.—*A*, base of a nose during quiet respiration. *B*, base of the same nose during forced respiration; the nostrils are maximally dilated, and one can note that the cartilaginous part of the naris is not widened, while the dorsal part of the naris is widened by dilation of the alae. (After Hans Virchow.)

The lower lateral cartilages are shaped like a horseshoe. The principle of this anatomic construction is generally used to maintain patency of the airways. Figure 5 *A* shows the base of a nose during quiet respiration. Figure 5 *B* shows the base of the same nose during forced respiration. The nostrils are actively maximally dilated. One can clearly note that the cartilaginous part of each naris is not widened but that the dorsal part of the nasal orifice shows an increase of the lumen by dilation of the ala. The special point of interest in figure 5 *B* is that the columella appears stretched to allow the passage of the maximum volume of air.

This stretching of the septum mobile is carried out by action of the depressor septi mobilis nasi (fig. 6).

Fibers of this muscle (*M*) are attached to the mesial crus (*C. a*) of the lower lateral cartilage. The mesial crura as a whole are thus pulled in a caudal direction and additional effort is given to assist the effect of the dilator muscles.

EFFECT OF THE "ANOMALOUS MUSCLE" ON FACIAL AND VOCAL EXPRESSION

Every mimetic movement consists of (1) contraction of muscle and (2) shifting of skin as a result of muscular activity. One can never observe the contraction of the muscle. But one can easily see the shifting of the skin, which is just as much a manner of communication of thoughts and feelings as articulated speech—therefore the name "facial expression."

The frightened, fearful cast in looking at a foe and the happy aspect in welcoming a friend are such natural and typical modes of expressing the feelings by outward signs.

The fact that only vision allowed perception of this sign language and that it is useless in the dark or in places where the view is obstructed

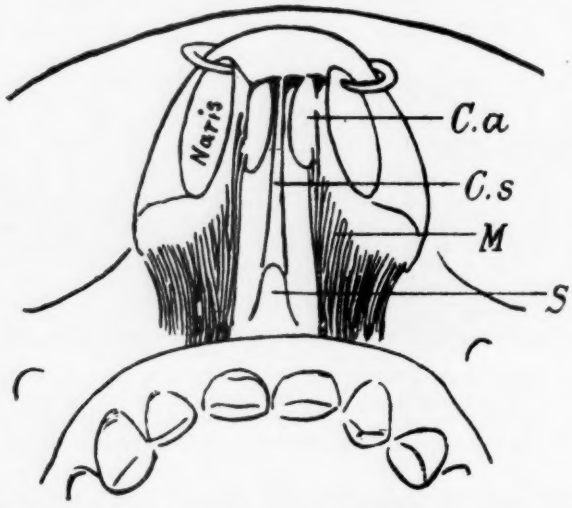


Fig. 6.—Appearance of the musculature of the base of the nose seen from below (after Hans Virchow). The skin and connective tissue have been partly removed. In the region of the nasal tip and the alae the skin is intact. A hook is placed in each nostril, and the tip is drawn cephalad and opened wide with the hooks. The muscle fibers of the musculus orbicularis oris are removed, permitting one to observe the muscular fibers of the musculus depressor septi mobilis nasi which run to the mesial crus of the lower lateral cartilage.

C.a indicates the mesial crus of the lower lateral cartilage; *C.s*, the caudal border of the septal cartilage; *M*, the musculus depressor septi mobilis nasi; *S*, the anterior nasal spine.

made it of limited application. The ability to express one's emotions by mimetic movements as a means of communication was probably gained before the acquisition of articulated speech.

There is hardly a human face without an "anomalous muscle." The "musculus anomalus nasi" and the "musculus anomalus maxillae" are of variable form and size and seem to be peculiar to man.

The anomalous muscle covering the bony vault is independent and can be separated from the pars transversa musculi nasalis (Virchow [12]).

The anomalous muscles arise and insert into the periosteum of the same bone with both ends. However, some are fastened only with one end to the periosteum. It is hard to believe that they are remnants without function. If they had not had a special mission, they would have disappeared long ago. The periosteum having a certain degree of extensibility can be somewhat distorted by them.

The functional value of the activity of the anomalous muscles lies in the fact that they stretch the tissues a very little and delicately change the tension of these tissues. These fine modifications in the compression of the tissues help to produce the subtle shades of facial expression.

Nature made use of the same principle of the "anomalous effect" in another communicative anatomic structure of micromechanic muscular activity, i.e., the margins of the glottis in tone production.

Negus [13] demonstrates a diagram of the innermost fibers of the thyroarytenoid muscle as they arise from and are inserted into the conus elasticus without reaching the arytenoid cartilage.

These fibers are known as the "ary-vocalis muscle." They can contract together with the other thyroarytenoid fibers or apart from these, independently.

I agree with Negus, who does not attach any exaggerated importance to them, but looks on them as serving a function of supplying rigidity and elasticity to the margins of the glottis.

ALTERATION OF FEATURES

Figure 7 demonstrates very well how the shifting of skin together with the underlying tissues of the lower part of the face changes the configuration of the upper lip and the nose. One may take notice of the interrelation of the skin of the middle and lower parts of the face.

Figure 7 shows changes in facial configuration resulting from an ability to dislocate the lower jaw at will in any direction (Sommer [14]).

However, regarding the present study the extensive shifting of skin shown in figure 7 or practiced in face lifting is of less interest than those minute changes which bear an unexpected influence on the congruity of the facial structures.

---

12. Virchow, H.: Die Anomalie des Mittelgesichts, Ztschr. f. Anat. u. Entwcklngsgesch. **84**:555, 1927.

13. Negus, V. E.: The Mechanism of the Larynx, St. Louis, C. V. Mosby Company, 1940, p. 378, fig. 136.

14. Sommer, R.: Die traumatischen Verrenkungen der Gelenke, Stuttgart, Ferdinand Enke, 1928.

Lange [15] describes the experiment which is represented in figure 8. *A* in figure 8 is a photograph of the original painting of Mona Lisa with her famous gentle enigmatic smile. In *B* the only change made is a retouching of 1 mm. at the angles of the mouth. In *C* 2 mm. at the corners of the mouth have been retouched. The effect is surprising. The characteristic ironic smile is completely lost by this relatively small change.

RHINOPLASTY

The shape of a good-looking nose should be related harmoniously to the surrounding areas. Nasal plastic surgery gets its best results when the deformity of the nose is the main incongruity and the other

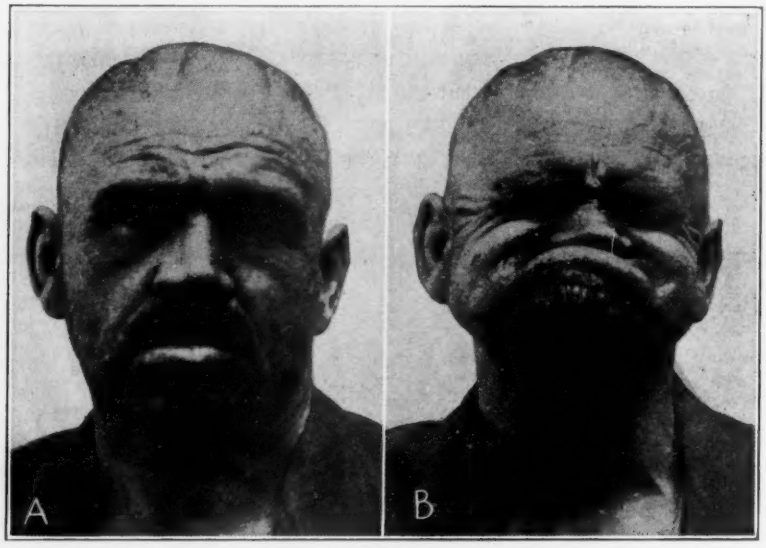


Fig. 7.—*A*, a person with the lower jaw in normal position. *B*, same person dislocating the lower jaw at will. (After Sommer.[14])

features are pleasing. But when the nasal deformity is combined with other bad facial appearances a careful preoperative analysis is essential.

In many cases the nasal deformity is actually only a party to a general facial disfigurement. The experience illustrated in figure 1 demonstrates that repair of the nasal deformity alone can improve the whole facial surroundings through rearrangement of tissue relations.

The elongation of the nose dislocates the lower part of the face, causing bending of the upper lip and inflection of the area between the lower lip and the chin. On the other hand, the shortening of the nose

15. Lange, F.: Die Sprache des menschlichen Antlitzes, Munich, J. F. Lehmanns Verlag, 1937.

brings about the restoration of unstrained muscular activity through elevation of the lower part of the face.

The reasons for this result are the anatomic conditions of the lower part of the face, a flexible body which yields easily to pressure and traction. The skin of the lower cartilaginous vault and the skin of the

Fig. 8.—*A*, original Mona Lisa as painted by Leonardo da Vinci (Louvre, Paris, France). *B*, the Mona Lisa with 1 mm. of the corners of the mouth retouched. *C*, 2 mm. of the corners of the mouth retouched.

chin are connected by a continuous sling of muscle fibers and by a tough connective tissue which holds the underlying structures together.

In cases of an elongated nose with an acute nasolabial angle, frequently the upper lip hangs down like a lifeless curtain.

After the operative procedure of shortening the septum by resecting a triangular piece of cartilage from the caudal extremity of the septal cartilage, the tip, i.e., the point where the nasal dorsum meets the ventral end of the columella, is raised and reattached by heavy silk sutures to the new septal line.

In this operative step the columella represents a lever the fulcrum of which is the point at which the columella is dorsally attached to the upper lip. This is the point of support about which the upper lip is made to turn ventrally.

Raising of the tip by turning the columella around its dorsal attachment and thereby increasing the nasolabial angle has a lever effect on the upper lip.

One can easily observe the elevation of the median part of the upper lip by raising one's own nasal tip with two fingers and notice the stretching of the frenum inside the buccal cavity.

If one remembers that the most cranial fibers of the upper portion of the musculus orbicularis oris are threaded through the dorsal attachment of the septum mobile and that the skin of the columella and the upper lip are "soldered" with the underlying tissues, one will understand that passive movements of one part affect the position of the other.

In addition, the rotation of the columella about its dorsal attachment as a pivot changes the interrelation of the two nasal and mental muscle rings.

This lever effect can be enhanced by transplanting a cartilaginous strut into the columella.

Figure 9 *A* and *B* shows a patient before and after nasal plastic treatment. The hump was removed, the nose shortened and a cartilaginous strut transplanted into the columella.

Figure 10 *A* and *B* shows the base of the nose of the same patient before and after the operation. *B* shows the raised tip and the rotation of the upper lip away from the teeth. A larger area of the vermilion border of the upper lip is clearly visible. The upper lip appears rotated ventrally, is more rounded and has a livelier outline.

The reconstruction of the nostrils and their boundaries is generally considered as one of the important steps in a nasal plastic procedure.

The anatomic relationship at the line of the union between the septum mobile and the septal cartilage must be borne in mind.

Figure 11 shows the contour of the caudal extremity of the septal cartilage and of the septum mobile as seen from the side. One may note that the septal cartilage turns dorsally in a slightly rounded curve at nearly a right angle and that it does not continue in a straight course to the anterior nasal spine but projects somewhat caudally before it reaches the spine in an almost horizontal line.

Fig. 9.—A patient before (*A*) and after (*B*) plastic correction of the nose. The hump was removed, the nose shortened and a cartilaginous strut transplanted into the columella.

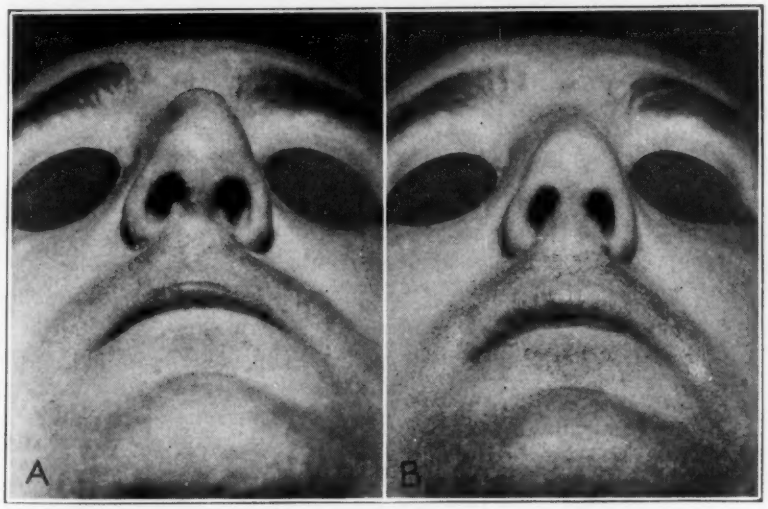


Fig. 10.—The base of the nose of the patient shown in figure 9. *A*, before plastic correction; *B*, after correction. In *B* note that with raising of the tip a larger area of the vermilion border of the upper lip is clearly visible. The upper lip is more rounded and appears rotated ventrally.

The septum mobile as seen from the side has the shape of a triangle with its base in the nasal tip and its apex near the dorsal end of the columella.

The distance from the cartilaginous septum to the outer contour of the columella decreases toward the attachment of the upper lip and increases from there again in the direction of the inferior nasal spine.

This projection of the cartilaginous septum helps to augment the difference in level between the alae and the columella.

In performing the transfixion one should remember this course of the caudal extremity of the septal cartilage.

After shortening the septum by a triangular resection, the new line of the cartilaginous septum should be shaped according to the small projection at the dorsal end of the columella. In this way the undesired result of an unsightly retracted columella, spoiling the cosmetic effect of the whole operation, may be avoided.

Fig. 11.—The relationship between the columella and the caudal end of the septal cartilage.

The same result can be achieved by preparing a cartilaginous strut slightly curved at one end to be transplanted into the columella.

The course of the nasolabial fold defining facial expression follows precise rules.

The line of the nasolabial fold can be changed by manifold surgical procedures such as:

(1) shortening of the nose and rotation of the columella,

(2) scar formation after osteotomy,

(3) narrowing of the nostrils,

(4) intranasal or intrabuccal attack and submerged sutures,

(5) swinging of the alae in a median, lateral, cranial or caudal direction (combination of two directions may sometimes be necessary),

(6) thinning of the dorsal attachment of the alae at the alar-facial groove by subcutaneous resection of connective tissue.

As the best technic for swinging of the alae, Weir's, Joseph's or Fomon's [16] method can be recommended.

This study was conducted with a view to finding new valuable additions to facial plastic surgery. The nasal deformity caught the surgeon's interest in the first place, but it might be necessary to develop the field of plastic surgery of the nose and bring it into relation to facial expression.

CONCLUSIONS

1. In cases of nasal disfigurement associated with distortion of the lower part of the face, plastic surgery of the nose can correct the entire group of features.

2. An analysis made to determine the factors of the interrelation of the nose and the area around the mouth yielded conclusions as follows: There is a potentiality that the enlargement of the area of the middle part of the face plays a decisive role in the distortion of the lower part of the face. Shortening of the nose by plastic surgery restores the regularity of the lower part of the face.

3. The skin of the nose and the skin of the chin are linked together by muscular and connective fibers.

4. There are four ways of muscular transmission: (*a*) the musculus orbicularis oris ring, (*b*) the figure of 8 shaped by the ring of the musculus nasalis and the ring of the upper lip–musculi triangulares–musculus transversus menti, (*c*) the sling of the musculi canini–musculi triangulares–musculus transversus menti and (*d*) the sling of the capita infraorbitales–lower lip.

5. The columella and the philtrum of the upper lip are joined together by firm connective tissue. The cranial fibers of the musculus orbicularis oris are threaded through the base of the septum mobile.

6. The columella exerts a lever effect on the upper lip.

7. The septum mobile from a side view has the shape of a triangle. The caudal end of the septal cartilage does not extend in a straight line from the nasal dorsum to the anterior nasal spine. It projects caudally before it reaches the spine in an almost horizontal line.

8. The nasolabial fold follows precise rules in defining facial expression. The fold represents a kind of watershed between two distinct muscle groups. Operative changes of the course of the nasolabial fold have a potential influence on the physiognomy.

9. The effecting of fine gradual changes through muscular adjustment is enacted in facial and in vocal expression by means of a similar micromechanical formation.

Dr. Samuel Fomon, New York, gave valuable advice; Miss Estelle Brodman, College of Physicians and Surgeons, New York, helped prepare the bibliography.

3 East Sixty-Sixth Street.

16. Fomon, S.: The Surgery of Injury and Plastic Repair, Baltimore, Williams & Wilkins Company, 1939.

INTRANASAL (SPHENOPHARYNGEAL) ENCEPHALOCELE

A Report of a Case with Intracranial Repair and a Review of the Subject

FRANK M. ANDERSON, M.D.
LOS ANGELES

CONGENITAL protrusion of the brain or the meninges through the skull is most commonly designated as hernia of the brain. This appellation is somewhat confusing, because it suggests the much more common extrusion of brain which may follow gunshot wound of the skull or various cranial operations, and for this reason many authors prefer the term "encephalocele." This designation is not entirely accurate, since the protruding mass may consist only of meninges (meningocele), but as a rule neuroglial as well as meningeal tissue can be identified in the sac, justifying the term "encephalocele" or the more unwieldly designation "encephalomeningocele." [1]

These herniations are considered to be brought about by faulty development of the fetal skull, protrusion occurring through a cleft between the skull bones or through a bony defect resulting from incomplete ossification. The commonest site for such dehiscence or maldevelopment is the midline of the occiput and, much less commonly, the midline of the skull between the parietal or the frontal ossification centers. Even less frequently herniation occurs at or adjacent to the base of the nose, the so-called sincipital variety of encephalocele; still less commonly, the sac presents itself within the nose, the pharynx or the orbit, constituting the basal variety of encephalocele. Sincipital encephalocele tends, with the passage of time, to widen the bridge of the nose and to separate the upper margins of the orbits. Similar distortion of the face is sometimes apparent in the presence of a low frontal encephalocele extending through the metopic suture. In both instances there is created a superficial resemblance to the syndrome of hypertelorism, an entirely unrelated entity.[2]

Basal encephalocele, the least commonly observed variety, is a hernia of the meninges or the brain substance which passes through the roof

---

From the Neurosurgical Service, Children's Hospital.

1. McGillicudy, O. B.: Encephalomeningoceles in Nasal Cavities, Ann. Otol., Rhin. & Laryng. **51**:516-525 (June) 1942.

2. (*a*) Greig, D. M.: Hypertelorism, Edinburgh M. J. **31**:560-593 (Oct.) 1924. (*b*) Stuart, E. A.: Otolaryngologic Aspect of Frontal Meningocoele: Report of Cases, Arch. Otolaryng. **40**:171-174 (Sept.) 1944.

of the orbit, the foramen cecum, or the cribriform plate of the ethmoid bone. Accordingly, Heinecke [3] has described three types, as follows: 1. Sphenopharyngeal, in which the hernia passes through an opening in the ethmoid or the sphenoid bone, or occurs at the suture between these bones, and presents as a spherical grayish mass in the nasal or the nasopharyngeal cavity. The case reported by Ingraham and Matson [4] and the case reported here are examples of this type of encephalocele (fig. 1). 2. Spheno-orbital, wherein the mass herniates through the superior orbital fissure and comes to lie in the posterior part of the orbit, causing pulsating exophthalmos (Dandy's [5] case). 3. Sphenomaxillary, in which the herniating brain or meninges pass through the superior orbital fissure into the orbit and downward through the inferior orbital fissure, reaching the pterygopalatine fossa. If sufficiently large, this type can be detected in the mouth as a protrusion of the mucous membrane medial to the ramus of the jaw, and externally as a bulge of the cheek below the zygoma. This type of encephalocele appears to be rare.

The commonest and most important type of basal encephalocele is the sphenopharyngeal. Here the hernial sac is contained within the pharynx or the nose, causing obstruction and deformity of the respiratory passages and offering a constant threat of spinal fluid rhinorrhea and meningitis, should rupture of the enveloping meninges occur. These features will be discussed in greater detail in a later section of this paper.

Rarely a patient may exhibit herniation elsewhere along the midline of the calvarium as well as basal or sincipital hernia—a state of multiple encephalocele. Occasionally additional defects, such as cleft palate, harelip and spina bifida, are present in the patient with anterior encephalocele,[6] but in most cases no other deformities have been described.

Three types of sincipital encephalocele have been designated by von Meyer,[7] as follows: 1. Nasofrontal, in which the herniating cerebral or meningeal tissue passes between the nasal and frontal bones and gives rise to a midline protrusion at the root of the nose. The swelling is entirely covered with skin, is smooth, rounded, fluctuant or firm, and

3. Heinecke, W.: Die chirurgischen Krankheiten des Kopfes, Stuttgart, F. Enke, 1882; cited by McGillicuddy.[1]

4. Ingraham, F. D., and Matson, D. D.: Spina Bifida and Cranium Bifidum: Unusual Nasopharyngeal Encephalocoele, New England J. Med. **228**:815-820 (June 24) 1943.

5. Dandy, W. E.: Operative Treatment for Certain Cases of Meningocoele (or Encephalocoele) into Orbit, Arch Ophth. **2**:123-132 (Aug.) 1929.

6. Stuart.[2b] Ingraham and Matson.[4] Dandy.[5]

7. von Meyer, E.: Ueber eine basale Hirnhernie in der Gegend der Lamina cribrosa, Virchows Arch. f. path. Anat. **120**:309-320, 1890; cited by Fenger.[14]

may or may not become tense when the intracranial pressure is increased by the child's crying or by jugular compression. 2. Nasoethmoid, in which the bony defect is located between the nasal, ethmoid and frontal bones, the external swelling appearing at the junction of cartilaginous and bony portions of the nose. 3. Naso-orbital, wherein the hernia

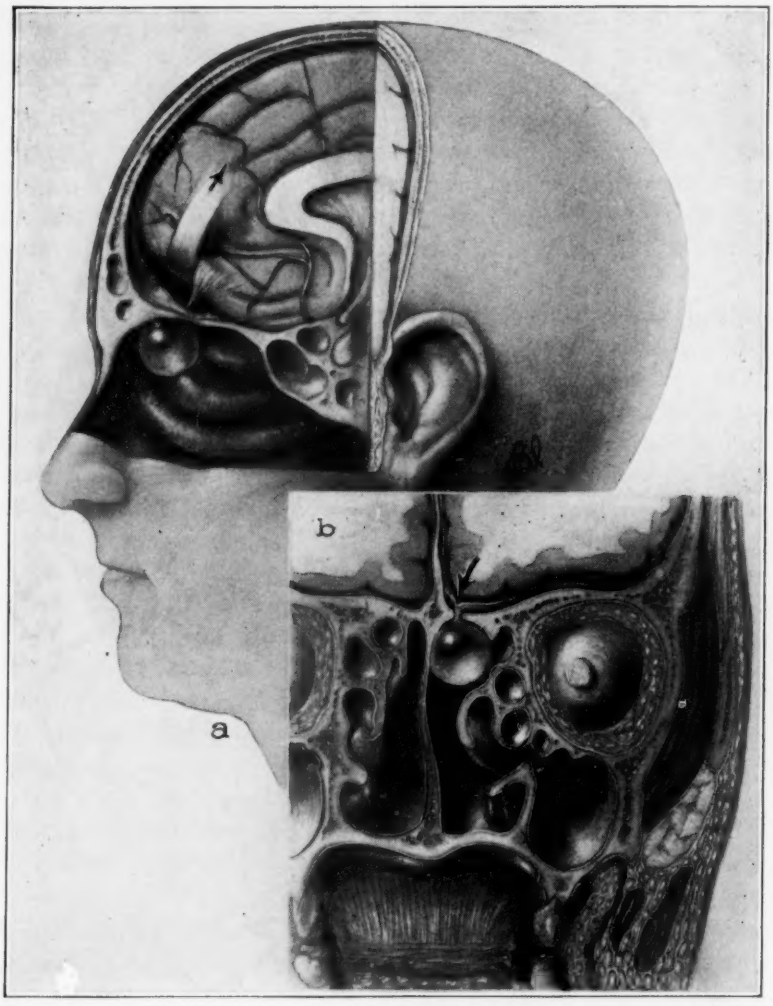


Fig. 1.—(*a*) Parasaggital view of a sphenopharyngeal encephalocele, showing the sac within the nasal cavity, with stalk passing through a defect in the cribriform plate.

(*b*) Coronal section showing the bony defect (arrow) and the relation of the encephalocele to adjacent structures.

escapes from the cranial cavity through a defect in the suture line between the frontal, lacrimal and ethmoid bones and proceeds into the orbit, causing protrusion of the tissues at the inner canthus of the eye.

Hernias of the last two types may on occasion be bilateral, in which event the patient will show similar protuberances on the two sides of the nose.

REVIEW OF THE LITERATURE

In their excellent statistical report on the subject of cranium bifidum and spina bifida, Ingraham and Swan [8] recorded a total of 84 encephaloceles observed in a twenty year period at the Children's Hospital in Boston. Of these the majority (63) were occipital in location; 9 were parietal, 6 frontal, and 6 were "anterior" encephaloceles, in terms of the types discussed in their paper. In only 1 of their collected cases did the brain herniate through a defect in the cribriform plate, and in reviewing this case Ingraham and Matson [4] stated that "anterior encephaloceles must be extremely rare." The patient was permanently cured by intracranial closure of the defect of the skull with a flap of dura mater.

McGillicuddy [1] cited 9 cases of sphenopharyngeal encephalocele reported prior to 1942 and described a case of his own. His patient was treated by snare removal of the large intranasal mass, a procedure which reduced the volume of the spinal fluid rhinorrhea but did not prevent a subsequent attack of meningitis, from which the patient recovered. McGillicuddy suggested intracranial closure of the defect of the ethmoid bone in this case but permission for further surgical operation was refused.

It was his feeling that intranasal encephaloceles are commoner than reports would indicate and he suggested that many "polyps" and intranasal "fibromas" are in reality brain or meningeal herniations. This view was expressed many years ago (von Meyer [7]; Hopkins [9]) and is undoubtedly correct.

Mood [10] found reports of 40 cases of anterior encephalocele in the literature and references to 35 other cases suggesting this diagnosis. Approximately 50 per cent of the definite cases were of the intranasal variety. He described 1 personal case, a nasoethmoid encephalocele cured by external incision and removal of the mass at the angle of the nose.

Funkhouser [11] reported a case in which swellings protruding bilaterally at the bridge of the nose were successfully treated by an intracranial

---

8. Ingraham, F. D., and Swan, H. N.: Spina Bifida and Cranium Bifidum: Survey of Five Hundred and Forty-Six Cases, New England J. Med. **228**:559-563 (May 6) 1943.

9. Hopkins, F. E.: Fronto-Nasal Encephalocoele, Laryngoscope **16**:720-722 (Sept.) 1906.

10. Mood, G. F.: Congenital Anterior Herniations of Brain, Ann. Otol., Rhin. & Laryng. **47**:391-401 (June) 1938.

11. Funkhouser, W. L.: Encephalo-Meningocoele Through Foramen Cecum, South. M. J. **15**:385-387 (May) 1922.

approach after turning down a bilateral frontal bone flap, the defect in the cribriform plate being repaired with a free transplant of skull bone and dura. He noted 2 previously reported cases of sincipital encephalocele showing paranasal protrusions in which no operation was performed and 1 case of basal encephalocele of the sphenopharyngeal type, the sac presenting in the nose; in the latter case the patient died of meningitis two weeks after intranasal ligation of the pedicle. Funkhouser's report appears to be the earliest record describing intracranial repair of an anterior encephalocele.

Dandy [5] treated an encephalocele which had protruded through a defect in the orbital roof behind the left eyeball, causing exophthalmos (Heinecke's spheno-orbital type). Intracranial exposure of the defect revealed absence of the left internal carotid artery and the cavernous sinus, as well as abnormal dilatation of the adjacent subarachnoid spaces. Closure of the defect with a piece of bone from the outer table of the skull resulted in complete cure of the pulsating exophthalmos.

Stuart [2b] described 4 cases of encephalocele; in 1 instance the herniation followed severe contusion of the face and was presumed to be post-traumatic in origin. Of the other 3 cases, 1 was of the basal variety, the encephalocele presenting in the nose and passing through a cleft palate into the mouth. Intracranial repair was performed by Dr. Wilder Penfield, but the infant died after operation. Stuart made the practical observation that encephalocele in the glabella might easily be mistaken in the adult for mucocele of the frontal sinus.

Rand [12] observed an infant with cerebral agenesis and bilateral naso-orbital encephalocele. Repair of one of the hernias by the intracranial method was unsatisfactory, and external operation was then carried out, with improvement in the cosmetic result. Rand cited a similar case in which the anomaly was treated in like manner by Sievers,[13] with complete cure.

Isolated cases of anterior encephalocele in which the condition was treated only by direct surgical attack on the herniating mass are reported by Fenger,[14] Miller,[15] Nordlund,[16] Lampert [17] and others.[18] It is probable

12. Rand, C. W.: Bilateral Naso-Orbital Encephalocoele: Report of Case with Surgical Treatment, Bull. Los Angeles Neurol. Soc. **2**:179-185 (Dec.) 1937.

13. Sievers, R.: Ueber nasoorbitale Encephalocelen mit besonderer Berücksichtigung eines durch Trepanation geheilten Falles, Deutsche Ztschr. f. Chir. **221**: 289-302, 1929; cited by Rand.[12]

14. Fenger, C.: Basal Hernias of the Brain, Am. J. M. Sc. **109**:1-17 (Jan.) 1895.

15. Miller, M. B.: Frontal Encephalocele, Tr. Philadelphia Acad. Surg. **14**:96, 1912.

16. Nordlund, H.: Ein Fall von Encephalocoele sinciputale, Acta oto-laryng. **1**:659-670, 1918.

that many more encephaloceles appearing in the orbit and in relation to the nose have been observed than the small number of reports in the literature would indicate.

REPORT OF A CASE

An 11 year old white boy was referred by Dr. Allen F. Sterling, of San Bernardino, Calif., with a diagnosis of intranasal encephalocele. When the boy was 4 years old a "nasal polyp" was removed surgically, a procedure which was followed by watery rhinorrhea and within a few days by an attack of meningitis. After recovering from this, the boy grew normally and appeared well, but the rhinorrhea continued in spite of numerous courses of nose drops and other intranasal medication, as well as a variety of systemic treatments for relief of "hay fever." Three years before the present hospitalization the patient began to have frequent colds with nasal obstruction, and his parents observed that whenever he had a cold the rhinorrhea stopped for several days, during which interval there was low grade fever. Not until September 1945, however, did the second attack of meningitis occur; this infection responded well to sulfonamide therapy, but within a month meningeal symptoms and fever recurred. Again there was good clinical response to sulfonamide compounds, but three weeks later (December 1945) the fourth attack of meningitis occurred, pneumococci being cultured from the spinal fluid. Sulfamerazine and penicillin therapy resulted in rapid improvement but, following this, it was decided that repair of the encephalocele should be attempted before another meningeal infection developed, and the boy was admitted to Children's Hospital on Jan. 27, 1946.

General physical examination disclosed no abnormalities; the boy was normally developed and well nourished, and appeared more intelligent than the average. His cooperation was excellent. Neurologic examination gave negative results except for faint signs of meningeal involvement; the sense of smell was normal (quantitative tests were not done), and other cranial nerve functions were intact. There were no deficiencies in motor, sensory or reflex function, and no deformities of the face or the head were apparent; rhinorrhea was not demonstrable in any position.

Examination of the nose (Dr. Harold Owens) disclosed a spherical glistening white mass about 1.5 cm. in diameter in the right nasal sulcus, almost obliterating the right middle turbinate and apparently originating in the cribriform plate or the superior meatus. Except for its unusual position this mass was similar in many respects to an ordinary nasal polyp.

Roentgenograms of the skull, including a mentobregmatic projection, failed to demonstrate abnormality of any sort; there was no visible defect of the cribriform plate. Hematologic studies revealed 11,250 white blood cells, of which 77 per cent were polymorphonuclears, 13 per cent lymphocytes and 9 per cent monocytes. The red cell count and the hemoglobin content were normal. Spinal puncture

17. Lampert, F. M.: Pathogenesis and Treatment of So-Called Congenital Cerebral Herniae, Surg., Gynec. & Obst. **38**:159-162 (Feb.) 1924.

18. (*a*) Olson, G. W.: Unusual Meningo-Encephalocoele Ethmoidalis: Report of Case and Review of Literature, Ann. Otol., Rhin. & Laryng. **46**:523-526 (June) 1937. (*b*) Nager, F. R.: Intranasal Encephalocoele, Schweiz. med. Wchnschr. **52**: 516-519 (May 25) 1922; cited by McGillicuddy.[1] (*c*) Rocher, H. L., and Anglade: Les fibrogliomes de la région nasale, Rev. de chir., Paris **62**:147-178, 1924. (*d*) Hopkins.[9]

showed the spinal fluid under normal pressure and dynamics; the fluid contained 40 polymorphonuclear cells and 38 lymphocytes per cubic millimeter. The Pandy test was negative, the Wassermann test was negative, and no growth appeared on culture.

The patient's temperature was 100.4 F. on admission but fell to normal in five days. He was given 100,000 units of penicillin intramuscularly daily for ten days preceding surgical intervention, and administration of sulfadiazine, 1 Gm. every four hours, was begun the day prior to operation; administration of both drugs was continued after operation.

Operation was performed on February 7, with the patient under anesthesia induced with solution of tribromoethanol U. S. P. A coronal incision was made just

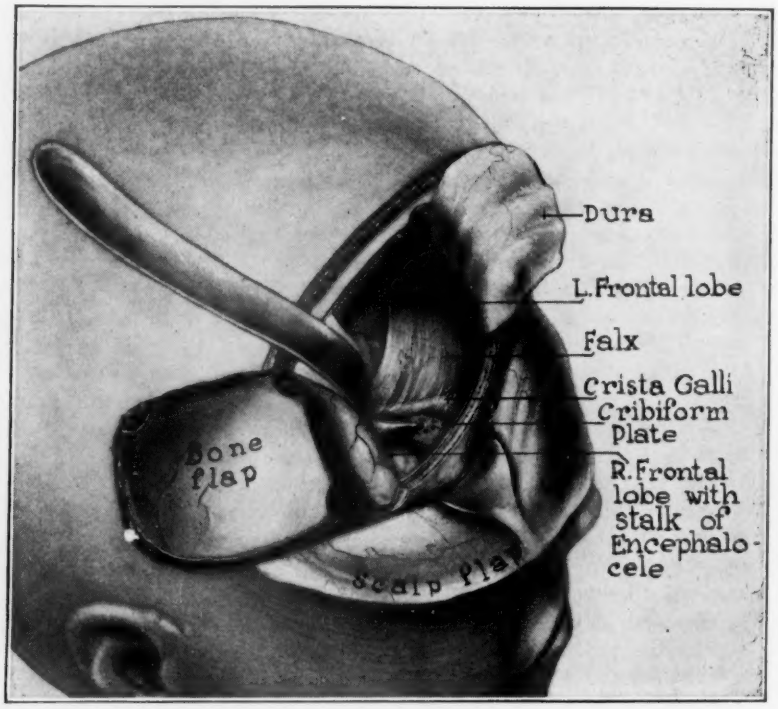


Fig. 2.—Operative exposure. The peduncle of the encephalocele is visible as a tapering stalk extending from the frontal lobe into the cribriform plate.

back of the hairline, and a right frontal bone flap was turned down close to the midline and as low as possible. A flap was not cut on the left because it was felt that unilateral exposure would be adequate, but as the operation progressed it became evident that a bilateral opening would have simplified the procedure by providing easier access to the cribriform area. The dura was incised transversely along the right frontal pole and the frontal lobe elevated intradurally, disclosing a slender filmy stalk of membranous tissue containing small blood vessels, extending from the medial surface of the tip of the right frontal lobe to the right cribriform area (fig. 2). In all other respects the exposed brain appeared normal. This stalk was cauterized and divided, and a defect about 2 mm. in diameter near the middle of the cribriform plate was identified as the site of emergence of the pedicle. The

aperture was cauterized lightly with the electrocautery, and a muscle strip was placed over the entire right cribriform area. Four dural flaps were then fashioned, brought over the muscle and sutured together, forming a secure closure of the defect. A strip of "gelfoam" soaked in thrombin was "glued" over the area, rendering the repair watertight (fig. 3). The brain was allowed to fall into place, the dura was sutured and the bone flap was wired in position. The scalp was closed without drainage.

The patient tolerated the operation well, awoke and took nourishment in a few hours, and showed no undue reaction to the procedure until the fifth post-

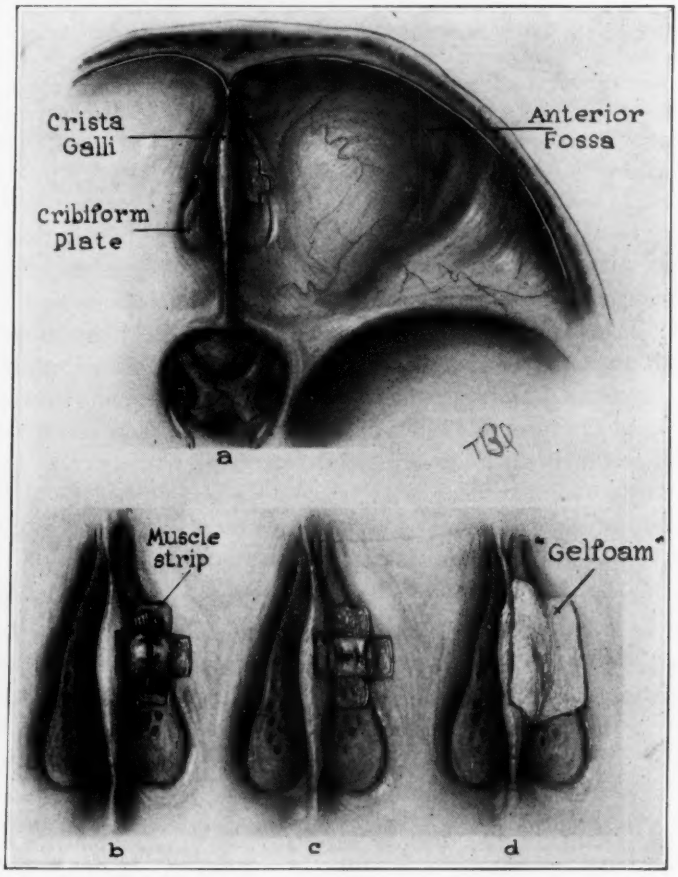


Fig. 3.—(*a*) Dural incisions designed to provide flaps for closure of the defect in the cribriform plate.

(*b, c, d*) Successive steps in the closure of the defect. The flaps of dura were brought up and sutured together over a strip of muscle; the cribriform area was then sealed with a patch of thrombin-soaked "gelfoam."

operative day, when he suddenly had a series of generalized convulsions. These were controlled with sedatives, and a spinal puncture was performed; the spinal fluid disclosed only 9 polymorphonuclear cells and 5 lymphocytes per cubic millimeter. Although there was no definite evidence of meningitis and but 1

degree of fever, 10,000 units of penicillin was administered intrathecally, sulfamerazine was given intravenously, and the intramuscular injection of penicillin was continued. There were no further convulsions, and the child remained asymptomatic and afebrile. All medication was discontinued on the ninth postoperative day; the boy was allowed to be ambulatory on the fifteenth day and was discharged from the hospital sixteen days after operation.

He was carefully reexamined six months after operation, at which time he was found to be in excellent health and entirely free of symptoms. There had been no headache or convulsive manifestations; the child was alert, active, well developed and intelligent. At no time since operation had there been rhinorrhea.

Examination of the nose showed the sac of the encephalocele to be greatly shrunken and collapsed, forming a small gray nub of tissue high in the right side of the nose. Aside from mild indentation of the right middle turbinate, no deformity of the nasal structures was apparent. Neurologic examination gave entirely negative results except for loss of the sense of smell on the right side; perception of odors in the left nostril was completely normal.

TREATMENT OF ANTERIOR ENCEPHALOCELES

If not treated, the sincipital encephalocele remains unchanged or enlarges slowly, constituting an unsightly external deformity and tending to cause distorted growth of the face and nose, with destruction of the bony portion of the nose, separation of the orbits and deformation of the frontal sinuses. Basal encephalocele causes persisting obstruction and distortion of the nose, the pharynx or the orbit and presents a constant threat of meningitis. If inadequately treated this variety may give rise to cerebrospinal fluid rhinorrhea, an annoying and potentially hazardous situation.

Several anterior encephaloceles have been treated, with variable success, by external or direct attack; that is, the sincipital variety, by incision over the mass and ligation of the pedicle,[19] and the intranasal (sphenopharyngeal) type of basal hernia, by snare removal, followed by cauterization or ligation of the stump.[20] In 2 reported cases of the first variety the hernia was treated by combined intracranial and external operation (Sievers; Rand). Objections to external repair of the sincipital variety are: The operative field, having free communication with the nose, is grossly infected; the stalk can rarely be freed completely from the bony opening, and a sufficient mass will therefore remain to cause persistent pressure and anomalous bony development; finally, an unsightly facial scar may result.

A serious objection exists to removal of the intranasal variety of encephalocele by snare or ligation in the nasal cavity, because with this technic a communication between the nose and the subarachnoid space is likely to be established, leading to persistent spinal fluid rhinorrhea

19. von Meyer.[7] Miller.[15] Nordlund.[16] Lampert.[17] Olson.[18a]
20. McGillicuddy.[1] Fenger.[14] Nager.[18b] Rocher and Anglade.[18c]

and meningitis. Permanent cure has rarely been obtained by the latter method.

Repair of all types of sincipital and basal encephaloceles is best carried out through an intracranial approach, using a unilateral (hypophysial) or bilateral frontal bone flap.[21] The frontal lobe is retracted intradurally, and the protruding mass of the encephalocele is delivered into the intracranial cavity, care being taken not to injure or disturb its enclosing meninges. If the protruding brain cannot readily be freed, the stalk of the encephalocele may be divided and the cerebral tissue carefully wiped out of the sac. The enveloping meninges are left in situ, because injury or penetration of these membranes will create a direct communication between the nasal cavity and the subarachnoid space, inviting meningitis. This empty thin-walled sac soon collapses and causes no symptoms. The bony defect may be closed with a plate of bone or of tantalum and the area completely covered by means of carefully sutured dural flaps or a free transplant of fascia. Tight closure of the dural defect is absolutely essential, and for this reason a muscle strip and "gelfoam" were employed in the present case to assist in rendering the closure watertight. No undue difficulties are to be expected in performing this operation, and the mortality should be low. It is wise to maintain the patient on sulfonamide or penicillin therapy or both before and after operation, to minimize the likelihood of meningitis.

The approach described in the foregoing paragraph is a standard neurosurgical means of access to the orbital roof, the cribriform area and the optic chiasm and has for several years been used with success when closure of lacerated dura and skull defect in the anterior fossa was performed for treatment of cerebrospinal fluid rhinorrhea following skull fracture.[22] A similar exposure is used in performing orbital decompression for exophthalmos (Naffziger and Jones [23]).

In the repair of encephalocele it is to be noted that this approach is made through a sterile field and that it affords much better exposure than the intranasal approach and provides considerably more satisfactory means of securing closure of the defect of the skull. The chance of successful repair with complete eradication of deforming protrusions and prevention of cerebrospinal fluid rhinorrhea and meningitis is far more certain when the intracranial method of repair is used. If the operation is carefully performed there will be no recurrence of the herniation, and permanent cure will result.

---

21. Stuart.[2b] Ingraham and Matson.[4] Dandy.[5] Funkhouser.[11] Rand.[12]

22. Adson, A. W.: Cerebrospinal Rhinorrhea: Surgical Repair, of Craniosinus Fistula, Ann. Surg. **114**:697-705 (Oct.) 1941. German, W. J.: Cerebrospinal Rhinorrhea: Surgical Repair, J. Neurosurg. **1**:60-66 (Jan.) 1944.

23. Naffziger, H. C., and Jones, O. W.: Surgical Treatment of Progressive Exophthalmos Following Thyroidectomy, J. A. M. A. **99**:638-642 (Aug. 20) 1932.

SUMMARY AND CONCLUSIONS

A case is described in which a sphenopharyngeal encephalocele passed through the cribriform plate of the ethmoid bone and presented itself in the nasal cavity. Successful repair of this deformity was accomplished by the intracranial route, and details of this procedure are given.

Successful intracranial repair of similar encephaloceles has been reported by four other writers, and the end result observed in each of the cases has been entirely satisfactory.

Several apparent cures have been reported in cases in which the treatment consisted in operating directly on the mass, with excision or snare removal; but in many instances fatal meningitis has followed the external operation, and it is concluded that this type of encephalocele is preferably repaired by the intracranial approach.

Intranasal encephalocele is probably more common than is generally believed. Since this protrusion resembles polyp and nasal fibroma, the possibility of encephalocele should be considered when a spherical mass is observed in the nose or the nasopharynx, particularly in infants or children.

1052 West Sixth Street.

OSTEOMA OF THE FRONTAL SINUSES

JOEL N. NOVICK, M.D., M.Sc.(Med.)
WASHINGTON, D. C.

OSTEOMA has been defined as a benign, slow-growing, encapsulated bony tumor attached to, or incorporated in, the bone from which it arises. From an academic point of view this definition may be fairly adequate, since osteoma does not metastasize, seldom recurs after removal and presents a microscopic picture characteristic of a benign growth. Yet from the clinical standpoint it is rather incomplete. As will be pointed out later in the discussion, this type of neoplasm may have either a slow or a relatively fast rate of growth, depending on the phase of bone development in which it appears. Then, again, though histologically benign, this tumor may become clinically malignant by virtue of being located in the proximity of many important structures.

The consensus of all those who have made a study of this subject is that osteoma of the nasal accessory sinuses is not a common condition and that it occurs more frequently in the frontal and ethmoid than in the other sinuses, and most frequently in the frontal sinus. Malan,[1] who had made an extensive review of this subject, collected 458 cases of osteoma of the nasal accessory sinuses and found that the tumor was in the frontal sinuses in 39 per cent of these, in the ethmoid sinuses in 24 per cent, in the antrums in 9 per cent and in the sphenoid sinuses in 1 to 2 per cent. In the series collected by Fetissof[2] the percentage distribution of the cases closely corresponded to that of Malan's series.

Attempts have been made to determine the decades of life during which this tumor may occur, and a variety of suggestions have been made. Smith,[3] in his discussion of osseous lesions of the nose and sinuses,

---

From the Department of Otolaryngology, George Washington University School of Medicine.

Read before the Surgical Staff of the Episcopal Eye, Ear and Throat Hospital, Aug. 2, 1946.

1. Malan, cited by Salvadori, G.: Osteoma of the Frontal Sinus, Arch. Otolaryng. **35**:671 (April) 1942.

2. Fetissof, A. G.: The Pathogenesis of Osteomas of Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **38**:404, 1929.

3. Smith, A. T.: Osseous Lesions of Nose and Sinuses with Special Reference to Hypertrophic Changes and Tumor Formations, Arch. Otolaryng. **31**:289 (Feb.) 1940.

concluded that osteoma may occur in this area from youth to the age of 30. Eckert-Moebius [4] reported a series of 276 cases, in which the ages of 163 were given, and in 70 of these the osteoma occurred in the third decade of life. According to Armitage,[5] the osteoma occurs in adolescence in 50 per cent of the cases and up to age 50 in 80 per cent of the cases. In Carmody's [6] series of 6 cases the ages ranged between 11 and 42, while Patriarca and Rossello [7] in 1934 reported frontal osteoma in a patient 75 years of age.

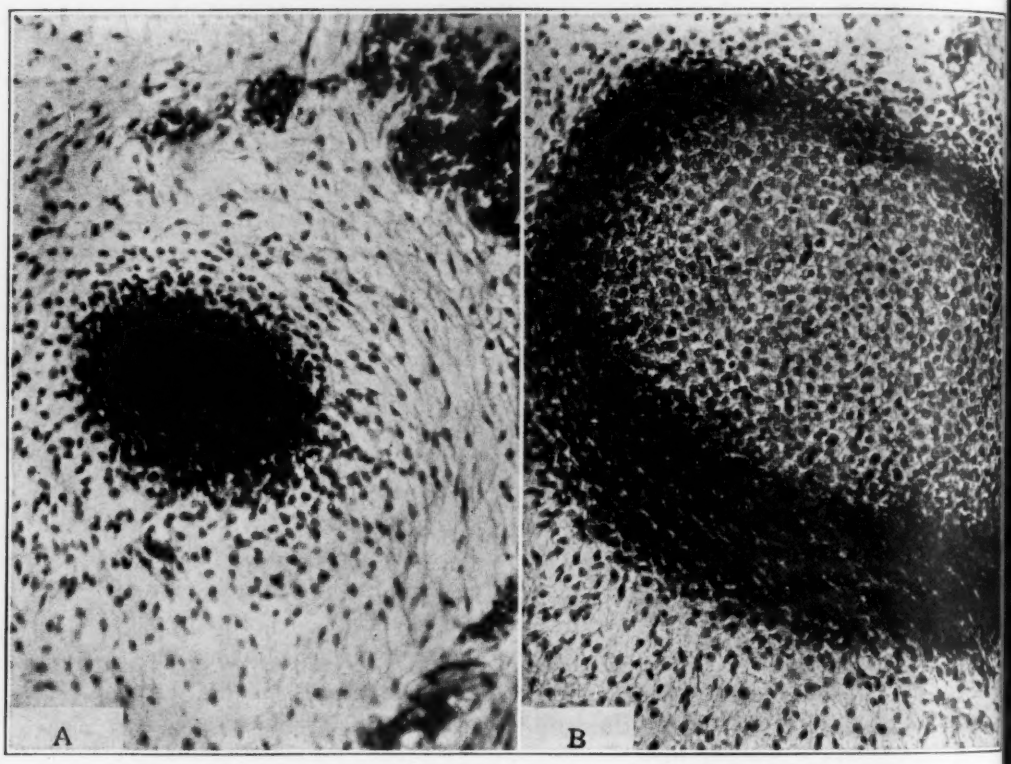


Fig. 1.—*A*, condensation of embryonic tissue at the site of the future skeleton of a human embryo.

B, precartilaginous condensation of connective tissue. Young cartilage cells are seen surrounded by a dense rim of connective tissue.

---

4. Eckert-Moebius, A., in Denker, A., and Kahler, O.: Handbuch der Hals-Nasen-Ohrenheilkunde, Berlin, Julius Springer, 1926, vol. 5, p. 118.

5. Armitage, G.: Osteoma of Frontal Sinus, Brit. J. Surg. **18**:565, 1931.

6. Carmody, T. E.: Osteoma of the Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **44**:626, 1935.

7. Patriarca, A. R., and Rossello, G.: Osteoma primitivo del seno frontale concomitante a mucocele fistolizzato nel'orbita in corrispondenza dell'angolo supero-esterno, Riv.oto-neuro-oftal. **11**:153, 1934.

However, in view of the fact that the osteoma may be either of the slowly growing or of the fast growing variety and the consequent variation in the rapidity with which the symptoms become part of the clinical picture, one can hardly fix, with any degree of accuracy, the decade or decades of life during which this type of neoplasm may invade the frontal sinuses.

Another point of issue, in reference to osteoma of the sinuses, is its etiologic explanation. This has created a most confusing controversy in view of the number of theories that have been advanced, some of which sound rather fantastic and can be regarded merely as opinions, representing purely theoretic speculation.

The most logical explanation of the cause and the mechanism of tumor formation in the paranasal sinuses has been offered by Geschick-

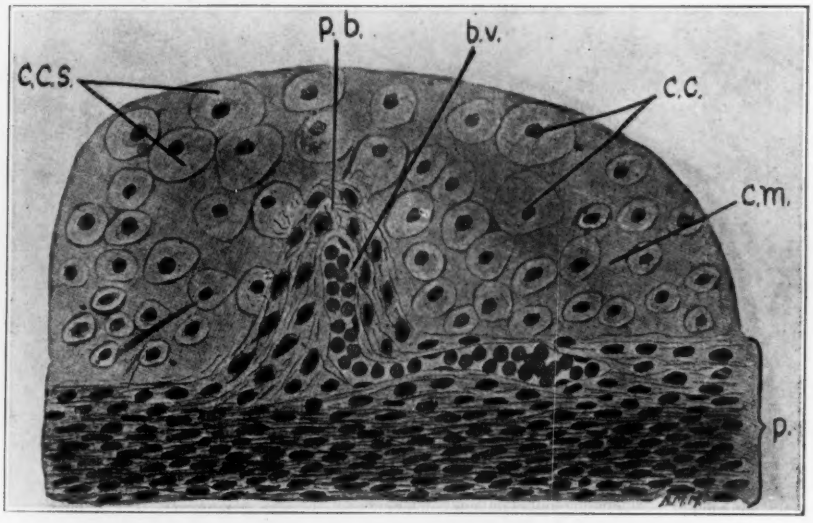


Fig. 2.—Intercartilaginous ossification. A periosteal bud is seen pushing into cartilage at an ossification center: *c.c.s.* indicates cartilage cell spaces; *p.b.*, the periosteal bud; *b.v.*, a blood vessel; *c.c.*, cartilage cells; *c.m.*, cartilage matrix; *p.*, periosteum (perichondrium).

ter and Copeland.[8] These authors based their reasoning on a premise that the development of the skeleton is at no time, in the life of the person, complete, and that at all ages there are places in the skeleton where transitional forms of the different tissues persist. Each transition represents a possibility of tumor formation.

They further argued that tumors of the bone are not dependent exclusively on the number of structural elements comprising the skeleton

8. Geschickter, C. F., and Copeland, M. M.: Tumors of Bone, New York, American Journal of Cancer, 1931.

but are dependent also on the developmental stages necessary for these tissues to reach the adult state. The majority of neoplasms of bone, they concluded, are definitely associated with different phases of osteo-

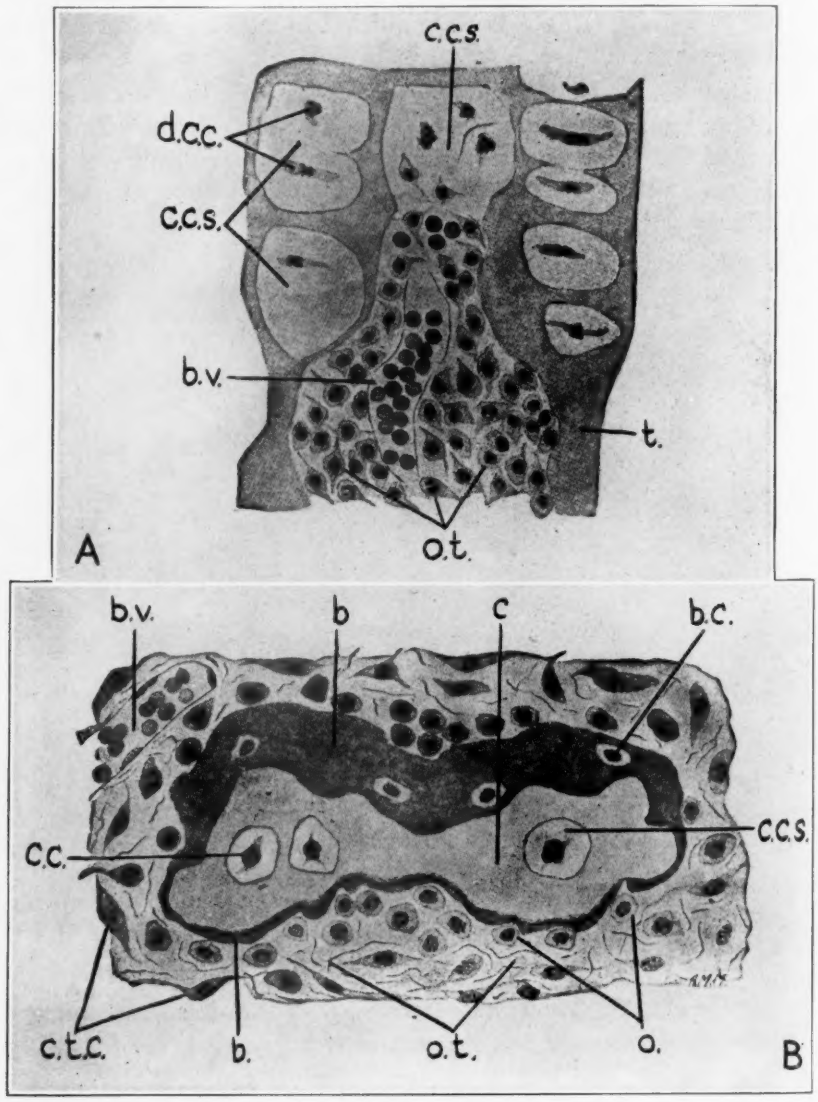


Fig. 3.—Intercartilaginous ossification. *A* shows osteogenic tissue pushing into cartilage, breaking it up into trabeculae: *c.c.s.* indicates cartilage cell spaces; *d.c.c.*, disintegrating cartilage cells; *t.*, trabeculae of cartilage; *b.v.*, blood vessel; *o.t.*, osteogenetic tissue in the primary marrow space.

B shows bone deposited around one of the trabeculae of cartilage: *b.v.* indicates a blood vessel; *b.*, bone; *c.*, cartilage; *b.c.*, bone cell; *c.c.*, cartilage cell; *c.c.s.*, cartilage cell space; *c.t.c.*, connective tissue cells; *b.*, bone; *o.t.*, osteogenetic tissue; *o.*, osteoblasts.

genesis. It is also true, however, that an occasional tumor may develop from marrow, vessels or overlying connective tissue, or may even invade from without.

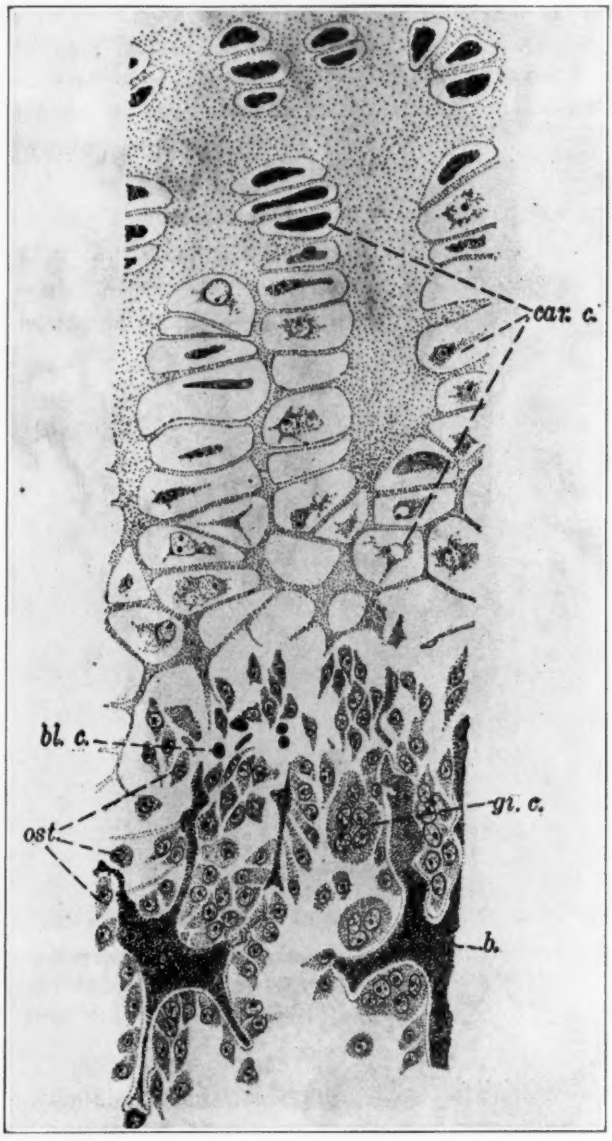


Fig. 4.—Intracartilaginous ossification. Cartilage cells are being resorbed and converted into young bone with the aid of osteoclasts and osteoblasts: *car.c.* indicates cartilage cells; *bl.c.*, blood vessel; *ost.*, osteoblasts; *gi.c.*, giant cell; *b.*, blood.

For a better understanding of the different phases of skeletal development, one must turn to embryology and the study of osteogenesis.

The basis of bone development is embryonic connective tissue. In the lowest form of vertebrates, connective tissue distended with fluid is the only skeletal element. Later in the scale of evolution cartilage and bone come into play in skeletal development. This sequence of events is found in the human embryo. In early embryonic life the future skeletal system is represented by a mass of connective tissue distended with fluid. As the embryo develops, some of the connective tissue con-

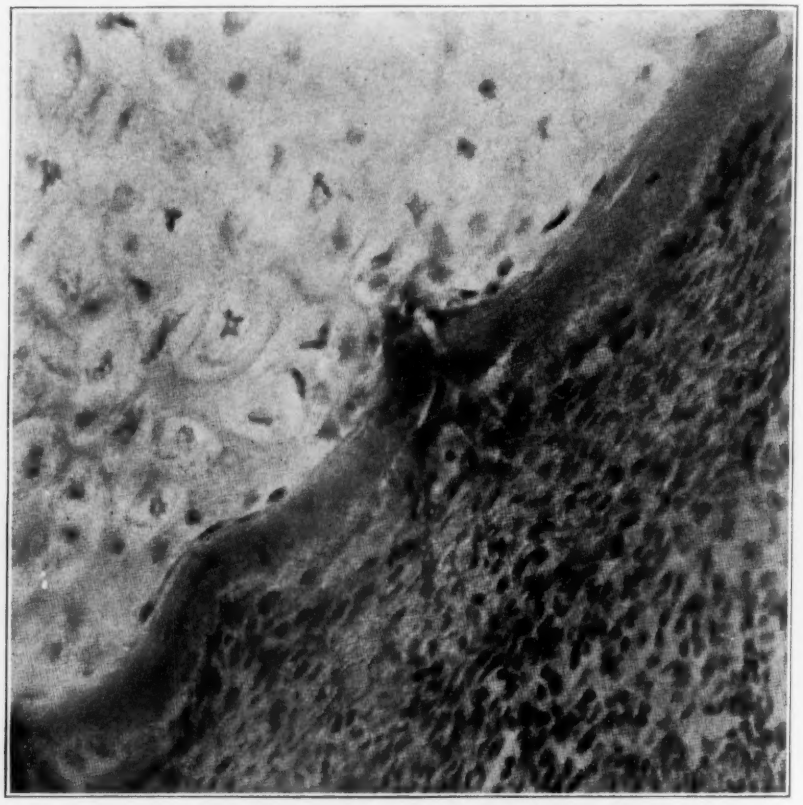


Fig. 5.—Intracartilaginous ossification. Calcified cartilage surrounded by osteoid tissue and cellular periosteum. In the center a giant cell (osteoclast) is shown perforating the osteoid cortex.

denses and gives rise to cartilage and later to bone, while other connective tissue gives rise to bone without the intervention of cartilage. The former process of bone development is called intracartilaginous ossification, while the latter is known as intramembranous ossification. Intracartilaginous, or enchondral, ossification is the process of development of the long bones of the skeleton. Here the embryonic connective tissue is transformed at first into embryonic cartilage, later into adult

cartilage, and finally, with the deposition of lime salts, into bone. Intramembranous ossification, on the other hand, takes place in the development of most of the flat bones of the skull. Here the lime salts, under the influence of the osteoblasts, are deposited in the connective tissue and, with several intermediary stages, such as osteoid body formation, but without benefit of cartilage, bone results. In the early stages of development the bone is spongy; later it becomes compact.

As osteoma can arise in any of the transitional stages of bone formation, and its consistency, consequently, varies with the consistency of the developing bone at the stage in which the tumor arises.

The pathologic classification of osteomas is therefore based on the consistency of the tumor. The more rapidly growing osteoma, which

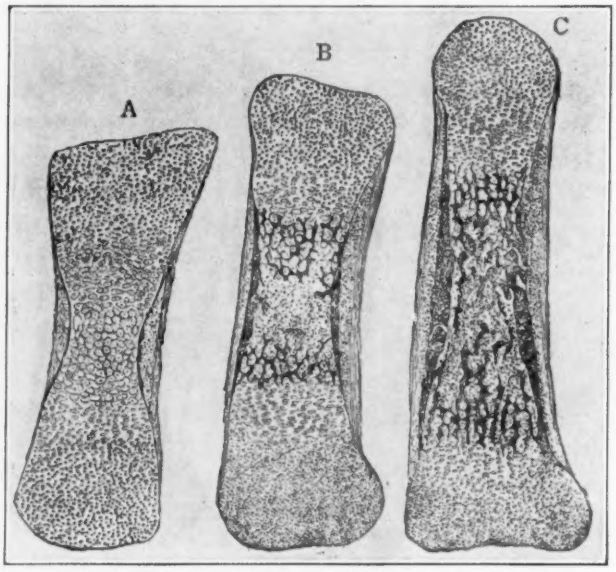


Fig. 6.—Intracartilaginous ossification. *A* shows cartilage cells gradually enlarging and becoming calcified at the center of ossification. In *B* calcification occurs. In *C* cartilage cells are gradually being absorbed.

is composed of fibrous connective tissue and osteoid bodies, is known as ossifying fibroma. The slowly growing osteoma, which consists of spongy bone, is called spongy osteoma. The highly differentiated osteoma consists of compact bone and is known as compact osteoma.

Microscopically, these tumors follow the same pattern of variations, and the histologic picture differs with different types of osteomas. The tumor may be of the spongy variety and contain osteoid bodies and marrow spaces, or of the compact type and contain haversian systems and compact lamellas. Occasionally these haversian systems may be irregular as compared with those of true bone, or even entirely absent.

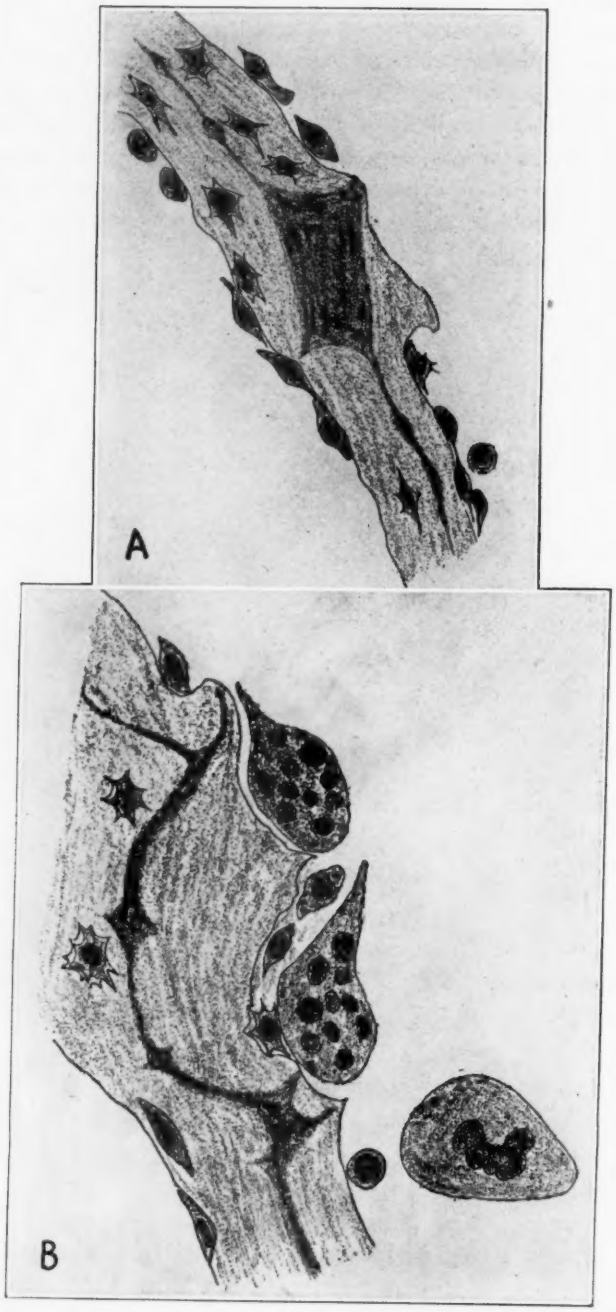


Fig. 7.—Intracartilaginous ossification. *A* shows a trabecula of bone with a central core of calcified cartilage; *B*, a trabecula of primary bone on which rest two osteoclasts.

An osteoma may be either attached to the bone from which it arises by a small spongy pedicle or incorporated in the mother bone over a larger area. On the other hand, it may be completely detached from the bone and lying free in the sinus. The latter type is known as a "dead osteoma."

The symptoms attributed to this disease arise primarily when the tumor presses on neighboring structures or interferes with the ventila-

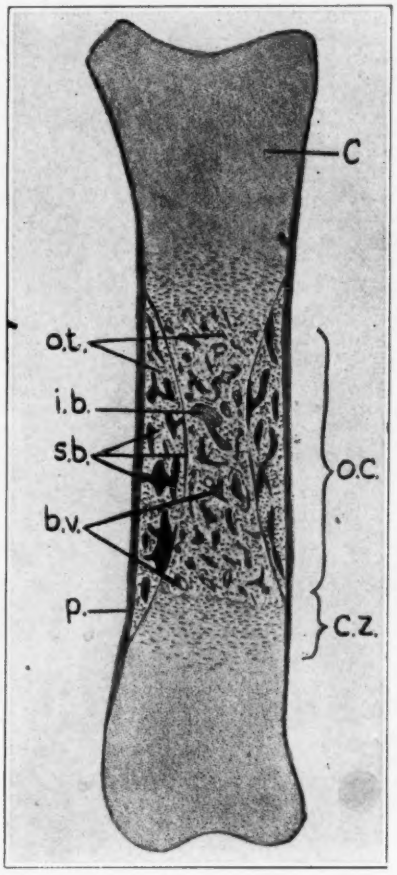


Fig. 8.—Intracartilaginous ossification. In this long bone various phases of ossification are shown: *c.* indicates cartilage; *o.t.*, osteogenetic tissue; *i.b.*, intracartilaginous bone; *s.b.*, subperiosteal bone; *b.v.*, blood vessels; *p.*, periosteum (perichondrium); *o.c.*, ossification center; *c.z.*, calcification zone.

tion and the drainage of the sinuses involved. Involvement and erosion of the posterior frontal plate may result in intracranial complications, such as meningitis, abscess of the brain or cerebrospinal rhinorrhea. When the anterior frontal plate is affected, deformity is usually present.

If the tumor extends into the orbit ocular symptoms will be produced, such as exophthalmos, proptosis or diplopia, depending on the area of the orbit involved and the direction of the pressure. Obstructing the nasofrontal duct, the tumor may produce a mucocele or a pyocele.

The symptoms referable to this clinical entity offer no criterion as to either the time of onset or the duration of the disease. The age of the patient at the time of consultation gives little clue to the time

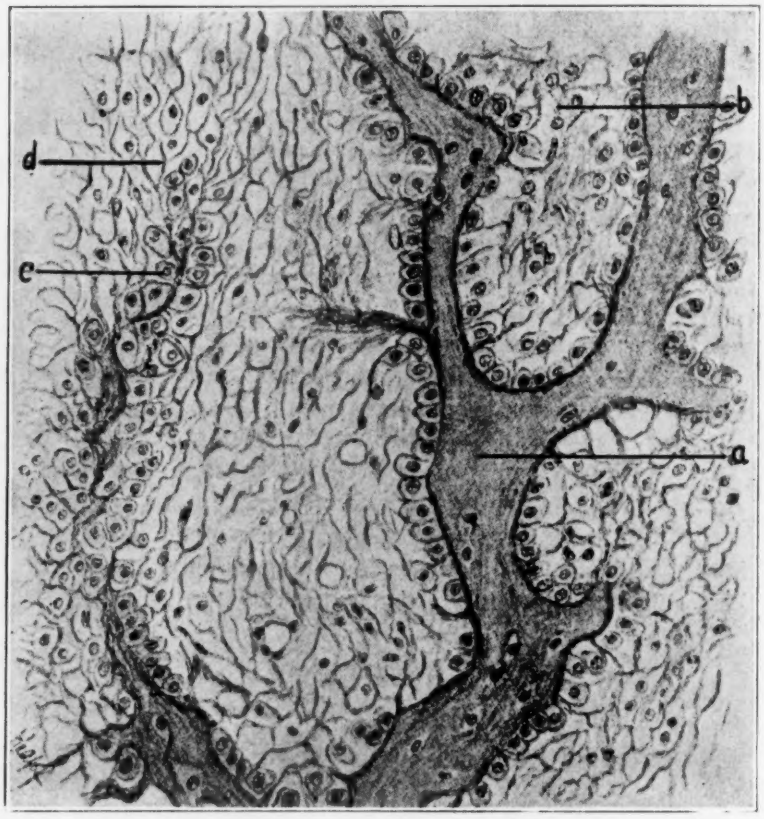


Fig. 9.—Intramembranous ossification. Bone is developing in osteogenic tissue: *a.* indicates bone; *b.*, a primary marrow cavity; *c.*, osteoblasts; *d.*, growing point of the primitive bone, beyond which primary marrow is developing in the connective tissue of the mesoblast.

when the tumor began to grow. As stated, in the case of a slow-growing osteoma the interval between the origin of the tumor and the appearance of the symptoms may be rather long. The reverse is true in the case of a fast-growing osteoma.

Consequently, in the absence of symptoms pathognomonic of neoplasm of the frontal sinus it has always been difficult to diagnose

such an entity, and it was only with the advent of roentgenology and its application to the paranasal sinuses that the diagnosis was facilitated. It was Coppez,[9] in 1899, who first employed roentgen rays for the diagnosis of neoplasms of the sinuses, and since then this method of investigation has become routine.

Thus, today, in the presence of symptoms suggestive of pathologic involvement of a sinus, one does not hesitate to order a roentgen investigation, and if such a neoplasm is present in the cavity, one has no difficulty in finding it. The only question that confronts one is what to do with it.

Surgical removal of the osteoma has been a point of controversy since the early part of the nineteenth century. MacKenzie[10] (1833),

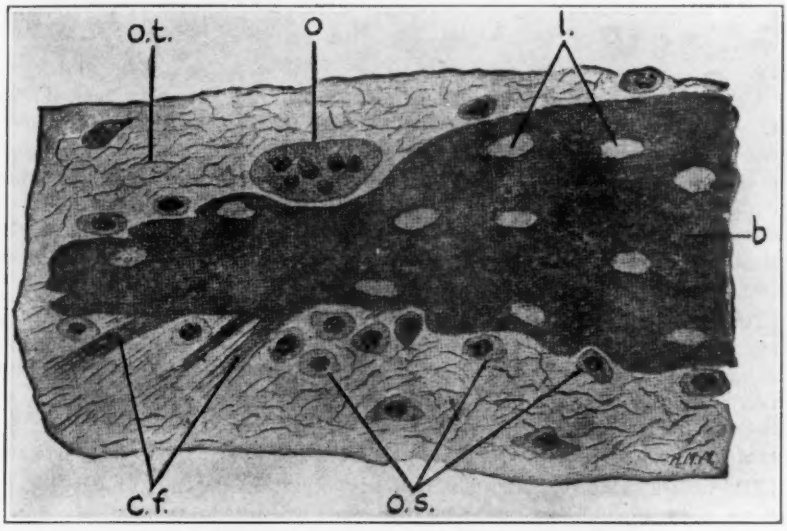


Fig. 10.—Intramembranous ossification. Bone is developing in osteogenic tissue.

Middlemore[11] (1935) and Dolbeau[12] (1865) advised surgical removal, while Berlin[13] (1880) called attention to a 25 per cent mortality and

9. Coppez, H.: Osteome du sinus frontal, Presse med. belge **51**:292, 1899.

10. MacKenzie, W.: A Practical Treatise on the Diseases of the Eye, Boston, Carter, Hendee & Company, 1833, p. 39; ed. 4, London, Longman [and others], 1854, p. 48, case 68.

11. Middlemore, R.: A Treatise on the Diseases of the Eye and Its Appendages, London, Longman [and others], 1835, vol. 2, p. 594.

12. Dolbeau: Exostoses du sinus frontal, Bull. Acad. imp. de med. **31**:1076, 1865-1866.

13. Berlin, R.: Die Osteome der Orbitus, in Graefe, A., and Saemisch, T.: Handbuch der gesammten Augenheilkunde, Leipzig, Wilhelm Engelmann, 1880, vol. 6, p 725.

strongly advised against surgical intervention. In the twentieth century the management of this condition still evoked differences of opinion. In 1918 Mackenty [14] considered an osteoma inoperable, while Joseph Beck [15] insisted that 48 per cent of persons with nonoperative osteoma will die of complications of the osteoma. Today surgical removal is not feared, but the question of the time of operation has produced two schools of thought. The French strongly urge that the surgeon operate as soon as the neoplasm is discovered, while the English and American surgeons suggest that operation be delayed until symptoms are established.

My personal feeling is with the conservative school of thought, and it was only because of the established distressing symptoms that I decided to operate in the case that I am about to report.

REPORT OF A CASE

A white woman aged 48 came into my office during the early part of April 1942, complaining of severe pain over the left frontal sinus and of double vision. These symptoms, she asserted, came on as an aftermath of a head cold of about two weeks' duration. She sought the advice of an ophthalmologist, who informed her that a nerve infection was present in the eye and that it could be treated medically. In spite of several treatments administered in the office of the ophthalmologist, the pain over the frontal sinus remained severe. She therefore decided to consult me.

This woman had been a patient of mine for several years prior to this incident, and at no time had she required any treatment for her nose or sinuses. Six months prior to this visit I had incised and drained an abscess of the cheek which complicated the extraction of a tooth. Twenty-five years before that she had an abdominal operation, the nature of which I have never discovered. The rest of the previous history, as well as the family history, was essentially irrelative.

The patient appeared uncomfortable and depressed but not acutely ill. Her general physical condition, including the blood pressure, was relatively normal. The only positive findings were (1) pain on pressure over the left frontal sinus and (2) inability to rotate the left eye lateralward when she was attempting to look to the left.

Suspecting a pathologic involvement of the left frontal sinus, I ordered a roentgen examination, and the report of the roentgenologist, dated April 18, was as follows: "Roentgenographic examination of the paranasal sinuses shows the frontal sinuses to be well developed, the left larger than the right. Both frontal sinuses appear to be clear. A large dense mass occupies the left frontal sinus. The mass is apparently an osteoma."

On the same day I hospitalized the patient and on April 20 performed a radical frontal sinusotomy.

Because of the size of the osteoma, I decided against the classic incision of the eyebrow and instead incised the skin immediately over this area. On open-

14. Mackenty, J. E., in discussion on Barnhill (1918) and Faulkner (1924).

15. Beck, J. C.: Some Uncommon Types of Neoplasms About the Head, Tr. Am. Laryng., Rhin. & Otol. Soc. **36**:374, 1930; Laryngoscope **40**:511 (July) 1930.

ing the frontal sinus I found the anterior wall and the floor of the sinus thinned out almost to the thickness of paper. The osteoma was pyramidal in shape, with the apex almost abutting the anterior frontal plate and the base incorporated in the

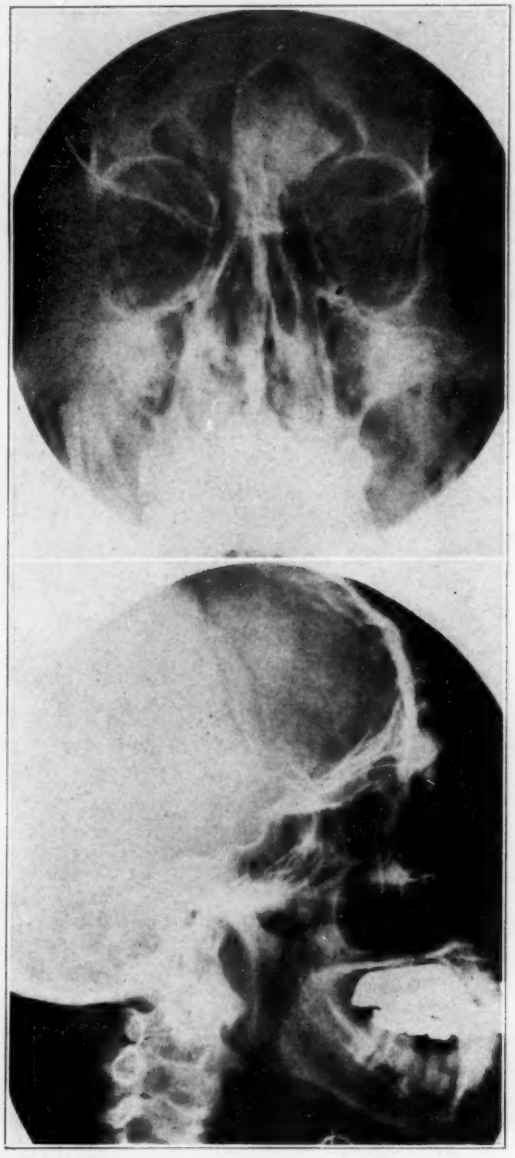


Fig. 11.—Roentgenograms made on April 18, 1942.

posterior frontal wall throughout the surface of the latter and part of the corresponding wall of the right frontal sinus. It also extended, as a nipple, down into the region of the left nasofrontal angle.

The tumor was of the compact variety, ivory in consistency and pearly gray in appearance. Its thickest point was at the nipple. Removal was possible only by

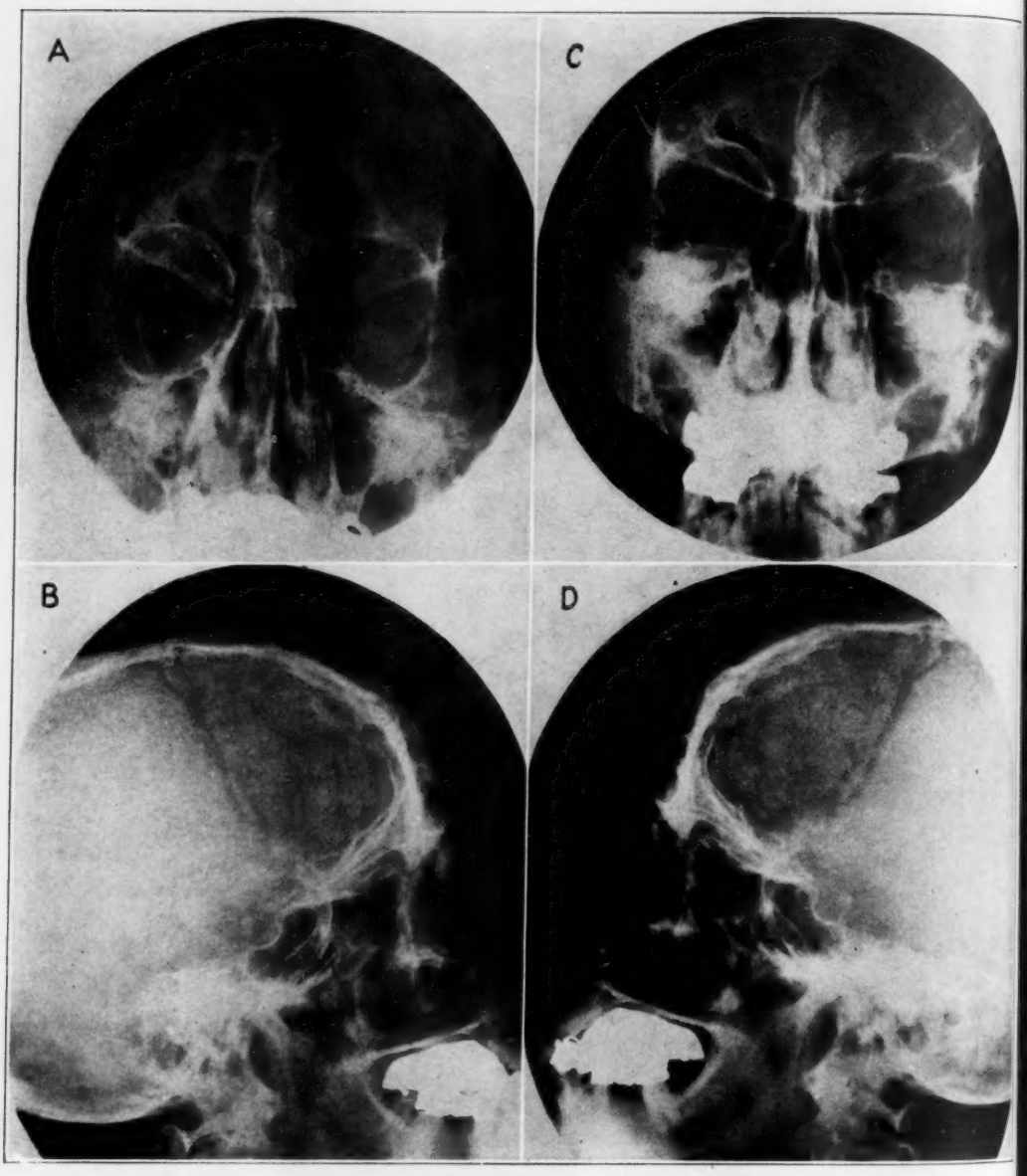


Fig. 12.—*A* and *B*, roentgenograms made on Sept. 28, 1942. *C* and *D*, roentgenograms made on Jan. 17, 1944.

the piecemeal method. An iodoform gauze drain was inserted into the nasofrontal duct, and the incision was closed with interrupted black silk sutures.

Convalescence was uneventful, and the drain was removed on the fourth postoperative day. Pain, the main symptom complained of, disappeared within twenty-four hours after the operation, but the diplopia persisted.

On May 21 I had her eyes examined. The report of the ophthalmologist follows: "The right eye is normal throughout. The left eye shows a healed incision line at the eyebrow, indicating the site of recent operation. The skin of the brow and the upper lid is insensitive to touch. The upper lid droops slightly. The corneal sensitivity is quite reduced; the cornea is clear. The pupil is round and regular, and reacts normally to stimulation. The eyeball is rotated nasally 40 degrees of the arc. It could not be rotated laterally beyond the midline. Vision with correction of a high degree of hyperopia was 20/30 in the right eye and 10/200 in the left eye. The patient stated that the vision of the left eye had always been poor, and this was, therefore, considered to be an amblyopic eye, since the fundi were quite normal."

On July 1, ten weeks after the operation, the patient came into my office to inform me of her loss of double vision and of her belief that the eye was normal again. Cursory examination confirmed the truth of her statement. Binocular vision was normal, and the ocular movements were synchronized in all directions.

On August 10 the eyes were again checked by the ophthalmologist, and his report was as follows: "The findings are exactly the same as in the previous examination except for a reduction of the esotropia to 15 degrees of the arc and a marked increase in the ability to rotate the eye laterally. It is possible to turn the cornea out almost to the external canthus. My impression is that there has been a paresis of the sixth nerve due to pressure of the tumor and that this is gradually clearing as a result of the removal of the growth."

Satisfied with the result obtained, I discharged the patient with instructions to return periodically for a check-up. My purpose in the subsequent examinations was to watch for possible recurrence of the osteoma, since I had foregone complete removal of the osteoma, which would have meant removal of the entire posterior frontal wall, in view of the danger of intracranial involvement. The reports of the subsequent roentgenographic examinations were as follows:

1. Sept. 28, 1942. Anteroposterior and lateral roentgenographic examinations of the frontal region show no evidence of erosion of bone, osteomyelitis or neoplasm. The base of the osteoma remains. The right frontal sinus is clear.

2. Jan. 17, 1944. Anteroposterior and lateral roentgenographic examinations of the frontal region show no change in the density of the left frontal sinus since the examination on Sept. 28, 1942. There appears, therefore, to have been no further regeneration of the previously treated osteoma.

3. Aug. 5, 1946. Reexamination of the paranasal sinuses shows no further change since Jan. 17, 1944.

To bring this case up to date, I made a special visit to this patient's home a few days ago (October 1946) and found her feeling fine and free of any symptoms referable to her head or eyes. She was happy to inform me that she has been feeling fine since the operation.

1726 Eye Street, N.W.

A DIFFERENT TREATMENT OF CHRONIC PURULENT OTITIS MEDIA

Deep Lavage, Aeration and Application of Gold Foil Membrane Bearing Ointment of Scarlet Red

MAX UNGER, M.D.
NEW YORK

ACUTE purulent otitis media usually resolves in a period that varies from a few days to a few weeks. If it shows no sign of healing in six to eight weeks, one may assume that it will become chronic. After that there is no way of telling by mere external examination whether it will last one month or fifty years. Conventionally made roentgenograms are not entirely satisfactory. Those made after an opaque solution has been instilled into the ear will give a much more complete picture of the amount of pneumatization of the temporal bone and will probably show that the greater the pneumatization, the longer the duration of the otitis.[1]

Estimates of the number of persons suffering from chronic purulent otitis media vary from 1 to 4 per cent of the population. This means that there are between 1,400,000 and 5,600,000 people who suffer from this disability in the United States, no doubt the largest group disabled from any cause. This huge total is a challenge to the medical profession. It calls for intensive efforts to eliminate the disease and is the justification for presenting this record of an attempt to solve the problem from a new angle.

Almost all known bacteria have been isolated from the aural discharges, and almost all applicable drugs have been used in the attempt to eliminate them. While a case of acute otitis can be classified as being caused by a specific bacterium, a case of chronic otitis cannot be so classified. The bacterial content often varies from time to time, and there are usually several varieties of bacteria present at the same time. If one type of bacteria is eliminated by treatment, it is apt to be replaced by another type as soon as treatment is stopped, so that the type of bacteria isolated in a case of chronic otitis media cannot be regarded as specific for that case. Most observers even believe that the bacterial content is unimportant in considering treatment and feel that proper cleansing is more important than the application of specific medication.[2]

---

1. Unger, M.: Contrast Roentgenography of the Pneumatic Cells of the Temporal Bone, Am. J. Roentgenol. **4**:384 (Oct.) 1945.

2. Hill, F. T.: Chronic Discharging Ear, Dis. Eye, Ear, Nose & Throat **1**: 112-116 (April) 1941.

In almost every other part of the body a localized infection can be cured if it can be reached and the site adequately drained, irrigated or medicated. In the ear manifesting chronic otitis media there are two openings for drainage, the eustachian tube and the perforation of the drum membrane, yet irrigation and medication as ordinarily applied are often of no avail. It is plain that this is due to the failure of the irrigating or medicinal fluid to reach all affected parts. This failure is due to the anatomic peculiarities of the temporal bone. These anatomic peculiarities are illustrated in figures 1 to 3. These are photographs of casts of the middle ear and its communicating cells.

Each cast was made by injecting the middle ear and the air cells of a temporal bone of a cadaver with a colored solution of methylmethacrylate, a plastic resistant to acid and alkali. After this had hardened, the sur-

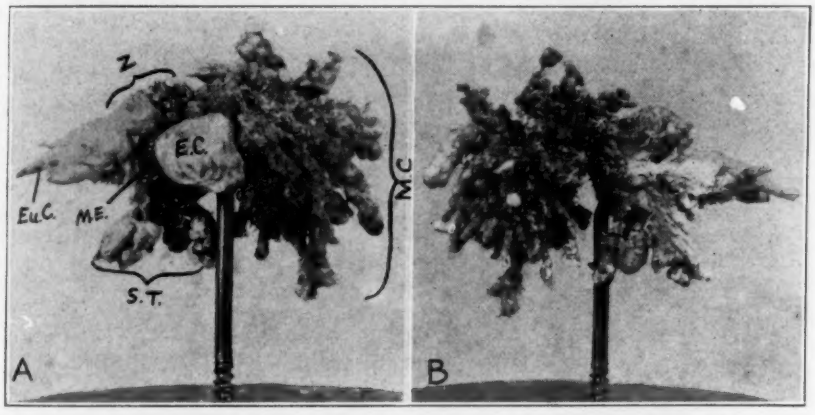


Fig. 1.—*A*, the external aspect of an injection model of the external auditory canal, middle ear and pneumatic cells of the temporal bone. What appears solid in the picture is actually air space in the bone. *E.C.* is the external canal; *M.E.*, the middle ear; *Eu.C.*, the eustachian canal; *M.C.*, the system of mastoid cells; *S.T.*, the subtympanic group of cells, *Z*, the zygomatic group of cells. This model shows clearly the multiplicity, complexity and tortuosity of the air cells communicating with the tympanum.

B, the internal aspect of the model shown in *A*. The depth, multiplicity and irregularity of the air cells are shown even more clearly in this photograph.

rounding bone was dissolved in alternate baths of concentrated nitric acid and potassium hydroxide. The models shown in the photographs resulted. They show the wide extent of the pneumatic system of the temporal bone. They also show the length, the irregularity, the tortuosity and the constrictions in the various groups of cells. Some cell chains extend 1½ inches (3.8 cm.) from the middle ear and have along their lengths four or five dilatations, connected by channels that are almost capillary in size. When one studies these models, it is easy to see how an infection can lodge and linger so long in these cells, and it is difficult to

conceive how ordinary irrigations, insufflations or even postural instillations of the external auditory canal can bring fluid or powder into them. The extent and the ramifications of the cells shown in these models also explain why mastoidectomy fails to clear up chronic otitis in so many

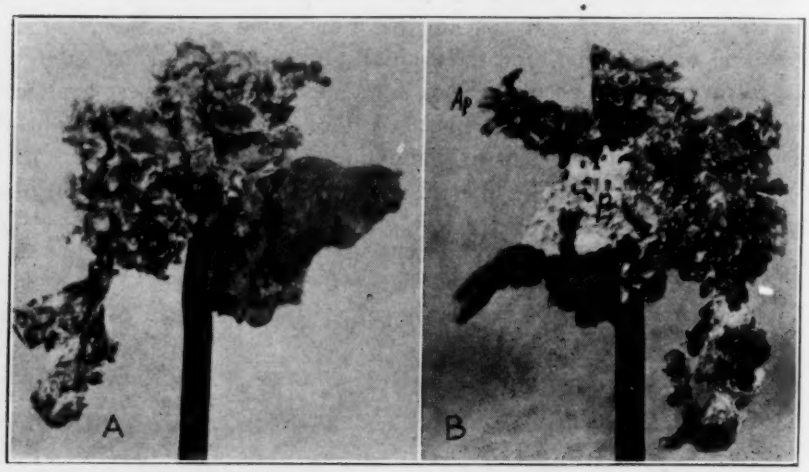


Fig. 2.—*A*, external aspect of a model made from another temporal bone. Here, also, the emphasis is on complexity and irregularity.

B, the internal aspect of the model shown in *A*. *Ap* is a chain of cells projecting into the apex of the petrous bone for a distance of 1 inch (2.5 cm.) *P* is part of the petrous bone.

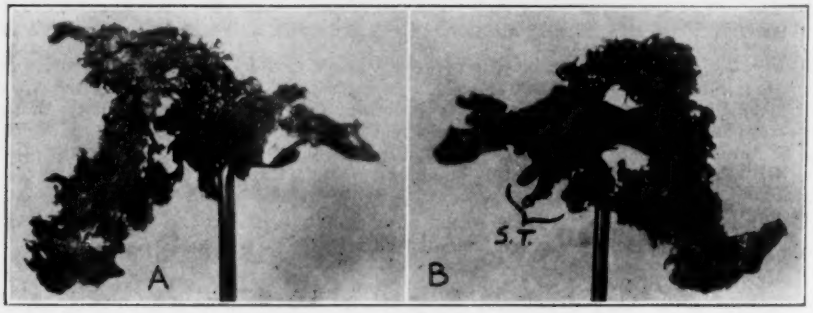


Fig. 3.—*A*, the external aspect of a model made from another temporal bone. Note again the complexity and tortuosity.

B, the internal aspect of the model shown in *A*. *S.T.* is a group of subtympanic cells that extend toward the apex of the petrous bone.

cases; the operation simply fails to reach the outlying cells. The problem, therefore, resolves itself into finding a means of cleansing and medicating these distant and inaccessible cells. This is attained with the apparatus and method of deep lavage described here.

APPARATUS AND TECHNIC

The apparatus is shown in figures 4 and 5. It consists of, *1*, a specially regulated piston pump that makes about 60 cycles or less to the minute, the pressure and the suction being both connected to the same nozzle, *2*, so that alternations of pressure and suction can be applied through the same tube at intervals of about one second. Then there is the rubber tube, *3*, which connects the pump nozzle with a glass trap, *4*, the purpose of the trap being to prevent fluids sucked out of the ear from entering the pump. The other end of the trap is connected by another tube, *5*, to a glass ear tip, *6*. On the pump cylinder there is a needle valve, *7*, to regulate the amount of pressure and suction.

The method of using the apparatus is pictured in figures 4 and 5. The patient places his head sideways on a head rest or the edge of a table so that the affected

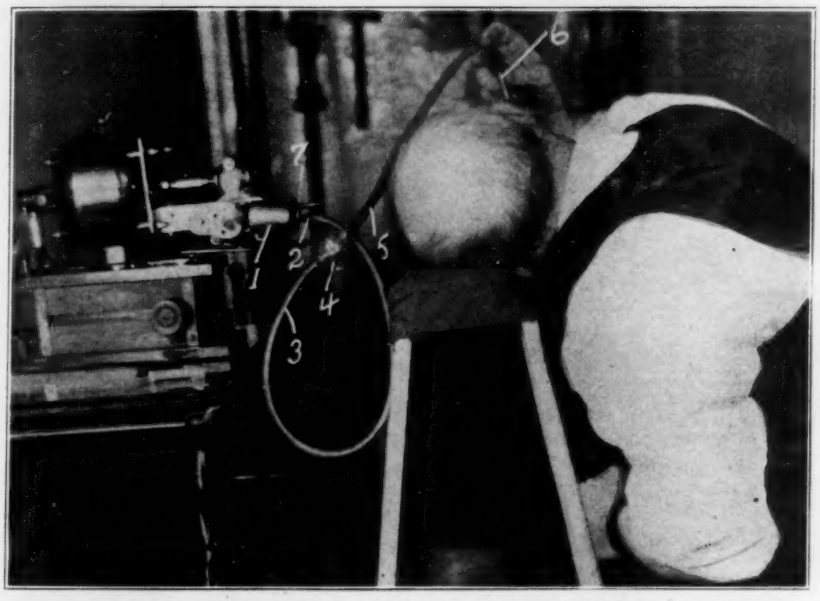


Fig. 4.—The apparatus and the patient in the first position for deep lavage. *1* is the cylinder of the pump; *2*, the nozzle of the pump; *3*, a rubber tube connecting the nozzle with *4*, a glass trap to prevent fluid from being drawn into the pump; *5*, a rubber tube from the other end of the trap to *6*, a glass ear tip; *7*, a needle valve to regulate the pressure of the pump.

ear is uppermost, as in figure 4. The external canal is filled with the solution chosen, warmed to body temperature. The ear piece is then fitted closely into the meatus, and the pump is started. Bubbles can be seen rising in the ear piece, and the fluid sinks into the ear. A cellular temporal bone can often hold 5 to 6 cc. of fluid. The pumping is kept up for one minute. Then the position of the head is reversed so that the affected ear is lowermost, as shown in figure 5, and the pump is operated again for one minute. The fluid can be seen accumulating in the trap, being replaced in the ear by air. After this, the head is reversed again, more solution is put in the canal, and the pump is applied, to be followed in one minute by another reversal of the head. This procedure is followed six times.

The pump creates suction and pressure up to 90 mm. of mercury. In some cases this amount of pressure causes the solution to be blown through the eustachian tube into the pharynx. If this happens, the needle valve, *7*, is loosened so that the pressure drops. Usually, the eustachian tube can resist a pressure of 40 to 45 mm. of mercury.[3]

The operation of the pump produces two mechanical effects in the ear. One is alternating hyperemia and ischemia, which has proved so beneficial in other locations. The other effect is an agitation of the fluid in the middle ear and cells so that these compartments are literally rinsed out.

This treatment achieves best results if it is given every day, but few patients can arrange for that amount of treatment. However, it should be given at least every other day. If three or four days elapse without a treatment, the discharge

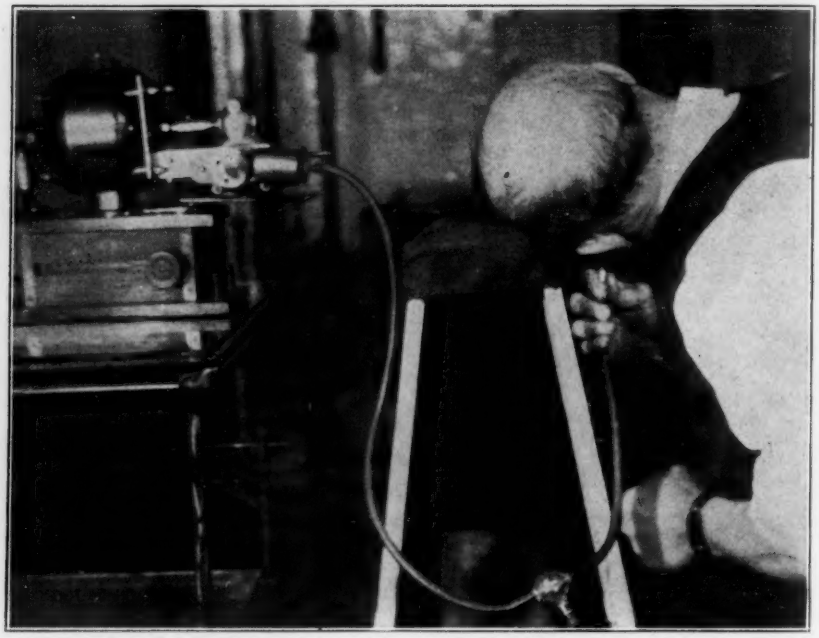


Fig. 5.—The apparatus and the patient in the second position for deep lavage.

is apt to return in full force. Before or after each treatment, the eustachian tube is catheterized. This helps to restore the tone of its mucous membrane and muscles. The patient is also directed to instil 5 drops of 1 per cent hydrogen peroxide into the ear and hold his head sideways for five minutes, morning and night.

The deep lavages are kept up for one week after the pus disappears. Then the use of fluids is discontinued, and only air is pumped in and out. The aeration is kept up till the perforation closes. This procedure serves to continue the application of hyperemia and ischemia to the mucous membrane of the middle ear and the connecting cells.

---

3. van Dishoeck, H. A. E.: Measurement of the Tension of the Tympanic Membrane and of the Resistance of the Eustachian Tube, Arch. Otolaryng. **3**:596 (Sept.) 1941.

The choice of solutions is important. Since cleansing of the middle ear and temporal cells is the objective, a solution with a minimum of viscosity is the most desirable. Glycerin solutions are not suitable. Experiments made with these solutions in glass tubes with lumens varying from capillary size to ⅛ inch (3 mm.) showed that the solutions remained almost stationary in the tubes while the pump was working. Isotonic solution of sodium chloride, 2 per cent boric acid and 1 per cent hydrogen peroxide are good. I prefer 1 per cent hydrogen peroxide because the nascent oxygen that it gives off is antiseptic and deodorant and helps to break up clumped pus. Three per cent hydrogen peroxide, which is the usual strength in which the peroxide is sold in ready filled bottles in drug and chain stores, may be used when there is much discharge, but after the discharge becomes scanty, the mucous membrane becomes more sensitive and the patients complain of deep burning pain when this strength is used. Then the 1 per cent solution must be used. Since the mechanical cleansing is the most important feature, the weaker solution may as well be used from the beginning.

A small perforation heals almost as soon as the pus disappears. It is well, however, to continue aerating the middle ear by eustachian catheterization three times a week for two weeks after the perforation closes, because the closure may mask a discharge that drains via the eustachian tube.

A large perforation, however, may last a long time and require special efforts to close it. The procedure I follow is to touch the edges of the perforation lightly with a cotton tip applicator coated with ointment of scarlet red N. F. If no progress appears in one week, I apply a gold foil patch over the perforation. The gold foil has the thickness that obtains when a gold beater is about three-quarters through with his job of beating out gold leaf. The gold is then less than a thousandth of an inch thick; it is strong enough to be handled, yet thin enough to be applied closely to the drum membrane. A disk is punched out that is about the size of the membrane. The side of the gold disk that is to lie against the drum membrane is coated thinly with the scarlet red ointment. The free end of a narrow, bent glass tube that has the other end attached to a rubber tube which, in turn, has a mouth piece at its other end is applied to the uncovered side of the gold disk. Suction is made on the mouth piece, and the gold foil is held at the end of the glass tube. The foil is then introduced into the aural canal close to the drum membrane. A light puff blows it against the membrane, and the ointment causes it to adhere. The gold disk is removed every second day for renewal of the scarlet red ointment and the application of aeration pumping. The disk can be dislodged from its position with a suction tube introduced into the canal or it can be blown out by eustachian catheterization. Ordinarily, the tympanic cavity has a slight vacuum, and when the gold foil seals the perforation there is a tendency to reestablish this vacuum, after which atmospheric pressure keeps the foil in position. Sometimes it is necessary to place a bit of fluffed cotton against the foil to hold it in position. The patient is cautioned not to blow his nose too vigorously, because that may dislodge the disk. The manipulation of the gold foil is a little bit tricky, the gold being somewhat elusive, but a little practice overcomes that.

The functions of the gold foil are to seal off the tympanum from external infection and to act as a support for the advancing margins of the perforation.

REPORT OF CASES

This method of treatment was started with 15 ears that had been running for periods ranging from three to forty-six years. Six of the patients discontinued treatment before the pus was cleared up. Nine

persevered to the end. Since the results were so good in these 9, brief résumés of their histories follow.

CASE 1.—The left ear of a man aged 22 had been discharging for twenty years. Occasionally the discharge stopped for a few weeks. There was profuse, thick, foul-smelling pus in the left canal. When this was wiped away, an oval perforation was disclosed, ⅛ inch (3 mm.) long, in the lower posterior quadrant of the drum membrane (fig. 6). Deep lavage with 1 per cent hydrogen peroxide carried out four times a week cleared up the pus in four weeks. A polyp had become visible, as the pus diminished, at the lower end of the perforation. The polyp disappeared after three more weeks of deep lavage. The use of hydrogen peroxide solution was discontinued, and only air was pumped in and out of the ear for one week. The edges of the opening were touched with scarlet red ointment. No progress was seen at the end of the week. A gold foil patch was applied over the perforation; it was removed every second day for deep aeration and application of fresh scarlet red ointment. A decrease in the size of the perforation was apparent in four days, with closure occurring in three weeks, eleven weeks after the start of treatment. The closure was intact seven months later.

CASE 2.—A man aged 52 complained that his right ear had been discharging for forty-six years. A polyp presented at the external auditory meatus, filling the entire canal. There was a thin purulent secretion around its margin. The polyp was snared off in two stages; after the second, the annulus tympanicus came into view. The polyp was attached to the promontory by a wide base, and the remaining stump filled the whole lumen of the annulus. There was no trace of the drum membrane. Deep lavage was given four times a week for three weeks, when pus disappeared. Five more weeks of deep lavage caused the polyp to disappear. The membrane was all gone, and the fenestra rotunda and the fenestra ovalis were partly visible; part of the malleus was seen at the upper rim. The incus and the stapes were gone. Lavage was discontinued, and deep aeration was done three times weekly for seven weeks. Scarlet red ointment was applied to the annulus tympanicus at each treatment. Fifteen weeks after the start of treatment there seemed to be a slight advance of tissue in the region of the stump of the malleus. A gold foil patch was applied over the whole lumen of the annulus tympanicus. The gold foil was removed three times a week for aeration and application of scarlet red ointment. After one week a definite advance of tissue had been made in the region where the fragment of ossicle was located. The diagrams (fig. 6) indicate the rate of progress. At the end of thirty weeks a thin membrane had completely replaced the destroyed drum membrane. The new membrane was adherent in the upper and central parts. It resisted eustachian catheterization. It was intact five months later.

CASE 3.—A woman aged 27 had a left ear that had been discharging for seventeen years. A profuse, thin, gray discharge issued through a perforation 1/16 inch (1.5 mm.) in size behind the base of the handle of the malleus. Deep lavage with isotonic solution of sodium chloride was done four times a week for four weeks, at the end of which the discharge was gone. Deep aeration was given for one week; then the patient was absent four days, and the discharge reappeared. Lavages were resumed, and the discharge disappeared in ten days. Aeration had been done for two weeks when the perforation closed, eight weeks after the start of treatment. It was still closed seven months later.

CASE 4.—A man aged 34 had a right ear that had been discharging for nineteen years, closing frequently but reopening in from two to three weeks. The discharge

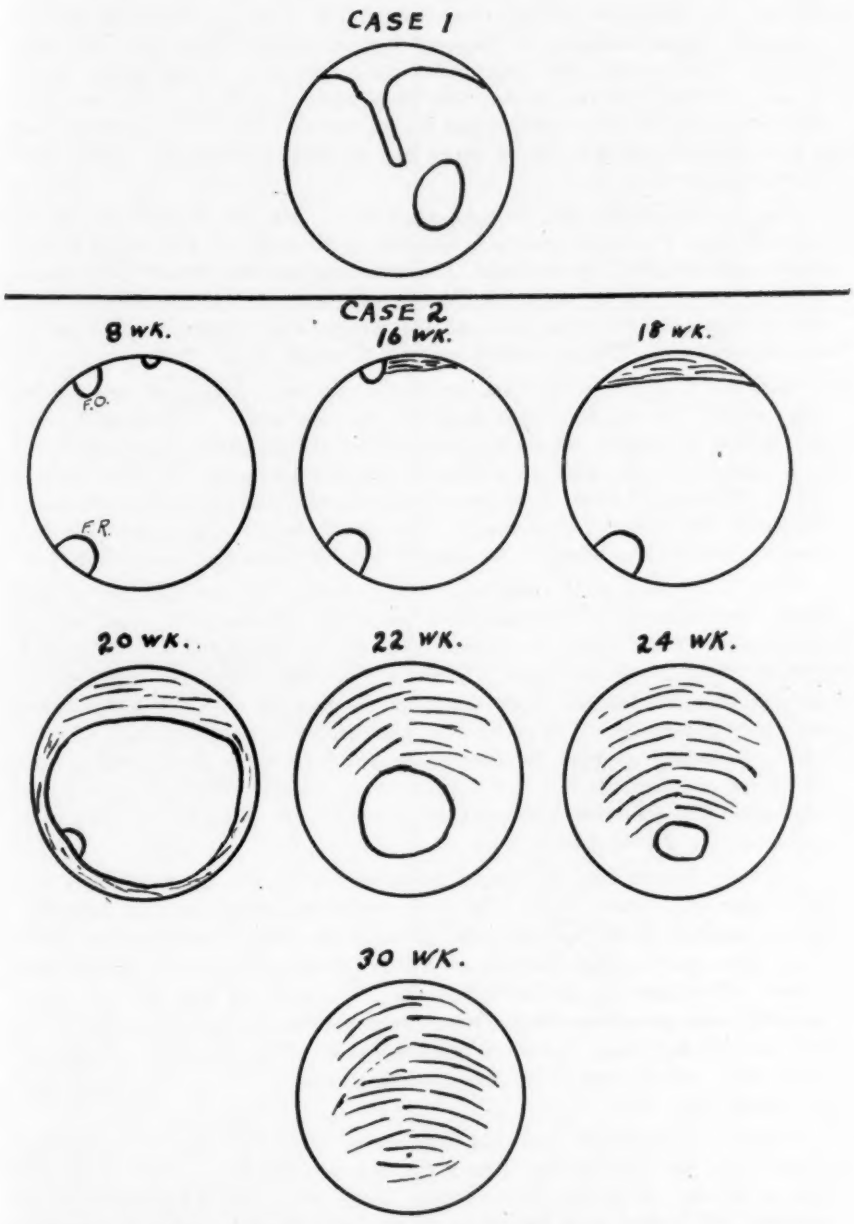


Fig. 6.—Diagrams of the perforated drum membranes in cases 1 and 2. The diagrams relating to case 2 show the gradual regeneration of a drum membrane that had disappeared, revealing the fenestra ovalis, *F.O.*, and the fenestra rotunda, *F.R.*

was thick, yellow and foul smelling. There was a kidney-shaped perforation, ¼ inch long and ⅛ inch wide (6.5 mm. long and 3 mm. wide) under the tip of the malleus. No polyp was visible. Deep lavage with 1 per cent hydrogen peroxide six times a week cleared up the discharge in three weeks. The patient was absent ten days. He returned with a recurrence of the discharge. Deep lavage cleared up this recurrence in two weeks; then deep aeration was given for one week. With use of a gold foil membrane and scarlet red ointment, the perforation closed in four weeks, eleven and one-half weeks after the start of treatment. It was intact six months later.

CASE 5.—This patient was the same as in case 4. His left ear had been running nineteen years. The drum membrane, like that of the right ear, presented a kidney-shaped perforation ¼ by ⅛ inch. The treatment and the course were exactly the same except that the discharge did not recur after the ten day absence. Gold foil was applied at the same time, and the opening closed twelve weeks from the start of treatment. The perforation was still closed six months later.

CASE 6.—A woman of 24 years complained that her left ear had been running seven years. The discharge was moderate, thin and gray. A small perforation was seen in Shrapnell's membrane, just back of the malleus. Deep lavage with 2 per cent boric acid solution six times a week cleared up the discharge in three weeks. Deep aeration was done for two more weeks, and the perforation closed, five weeks after the start of treatment. The eustachian tube was catheterized three times a week for two weeks. The closure held and was intact five months later.

CASE 7.—A youth of 17 years had a right ear that had been running for eight years. The discharge was profuse, thick and smelly. There was a round perforation, 3/16 inch (about 5 mm.) in diameter, with polyp filling it and protruding partly from it. Deep lavage four times a week for five weeks with 1 per cent hydrogen peroxide brought cessation of the discharge. Four more weeks of lavage caused the polyp to disappear. The perforation was reduced in size to ⅛ inch (3 mm.). After two weeks' aeration the opening remained the same size. Gold foil and scarlet red ointment closed it in five more weeks, sixteen weeks after the start of treatment. The eustachian tube was catheterized for two weeks more. The closure was intact six months later.

CASE 8.—A man aged 26 sought treatment for his left ear, which had been discharging for thirteen years. The drum membrane showed an oval perforation almost as large as its posterior half. Part of the fenestra rotunda was visible at the lower end; a polyp filled the upper half. Deep lavage was given four times a week, with 1 per cent hydrogen peroxide. The pus was gone in four weeks; the polyp was gone three weeks later. Deep aeration was given for one week; then gold foil and scarlet red ointment were applied. The perforation closed seven weeks later, fifteen weeks after the start of treatment. The closure was intact six months later.

CASE 9.—A woman 30 years old had running of the right ear for three years, a thin, gray discharge issuing from a 1/16 inch perforation posterior to the malleus, at the edge of Shrapnell's membrane. Deep lavage with 1 per cent hydrogen peroxide four times a week cleared up the discharge in three weeks; lavages were given for two more weeks. Aeration and scarlet red ointment closed the perforation in two more weeks. A severe cold reestablished the perforation and the discharge. Deep lavage stopped the discharge in one week; aeration and scarlet red ointment closed the perforation again in one week, nine weeks after the start of treatment. This closure was intact five months later.

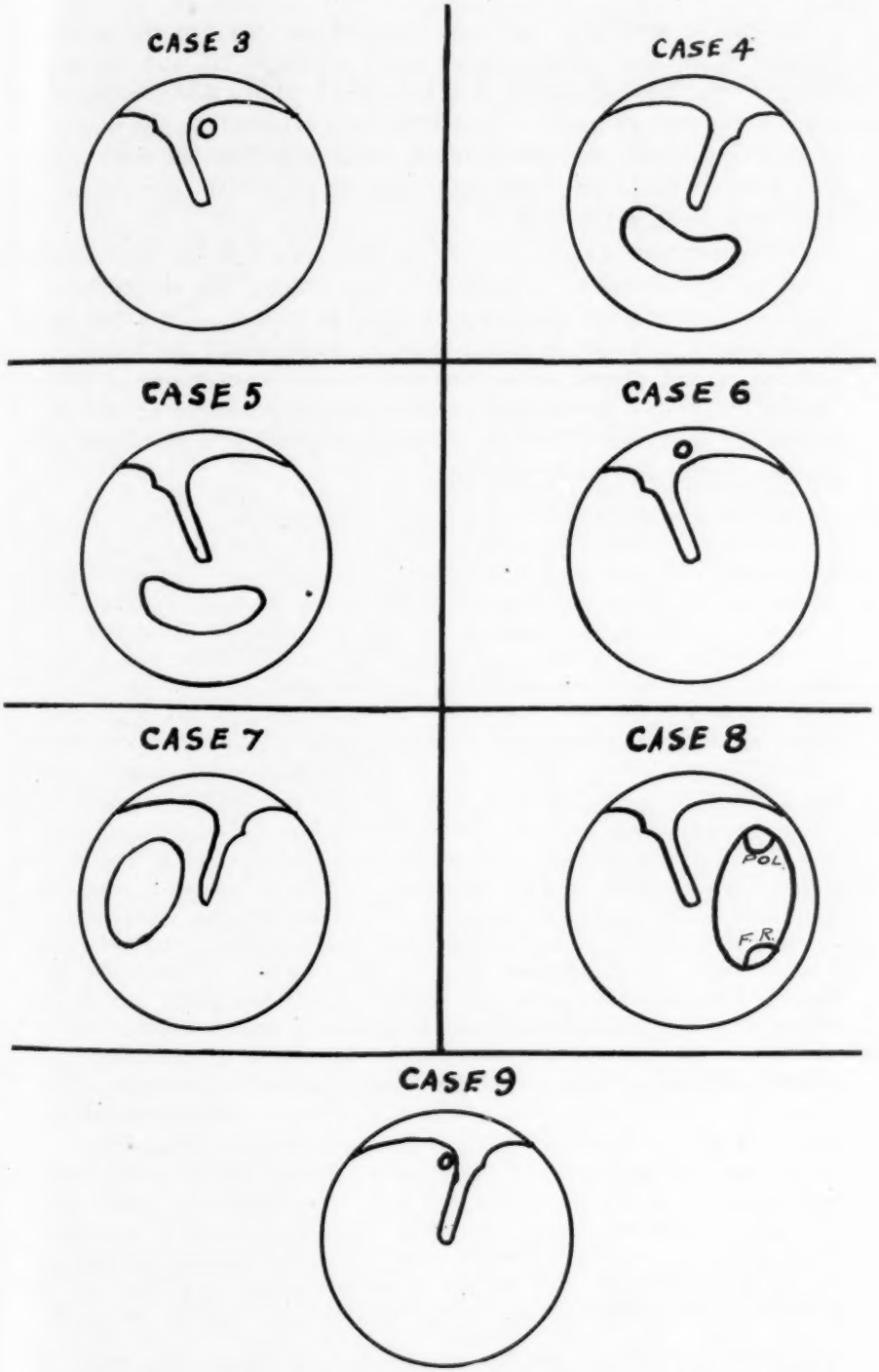


Fig. 7.—Diagrams of the perforated drum membranes seen in cases 3 to 9. In that relating to case 8 a polyp, *Pol.*, and the fenestra ovalis, *F.R.*, were seen through the perforation.

As can be seen from the cases reported, the pus and the polyps disappeared in from three to nine weeks (average, six and one-half weeks). The perforations closed in from five to thirty weeks (average, thirteen and one-half weeks). One might have expected the perforations to close sooner than they did after the pus disappeared, but there may have been discharge that drained through the eustachian tube and was not visible through the canal.

This treatment is radically different from any that has been tried hitherto. It is based on premises as to the cause of the chronicity of chronic otitis media that have not been stated previously. The excellence of the results, however, indicates that the premises and the treatment are correct and proper. The treatment is not an easy one to give. The administration of it requires patience and perseverance of both patient and physician. If the two cooperate, however, it is possible to do something with this baffling disease.

36 West Fortieth Street.

Clinical Notes; New Instruments and Technics

PYRIDOXINE (B6) USED IN THE TREATMENT OF VERTIGO

ALFRED LEWY, M.D.
AND
NOAH FOX, M.D.
CHICAGO

NO ATTEMPT will be made to describe this fraction of the B complex from the standpoint of pharmacology. It has been used empirically and with considerable success in a number of conditions, apparently unrelated pathologically, such as granulocytopenia, vomiting of pregnancy, and radiation sickness, and, with reported improvement, in paralysis agitans, or the Parkinson syndrome, and other organic diseases of the nervous system.

A year ago one of us observed a patient with inner ear deafness, that is, with shortened bone conduction and loss of hearing principally for high tones, whose audiograms taken over a period of years showed progressive deafness and who complained that he heard a peculiar snapping noise in one ear. The symptoms were not relieved by local treatment or by the administration of nicotinic acid (niacin) or neostigmine, but after five weeks of treatment with pyridoxine a 10 to 15 decibel improvement was noted in hearing in the speech range and beyond, with satisfactory subjective improvement of the hearing, but no lessening of the noise. This led to our using pyridoxine empirically for vertigo, both that diagnosed as Ménière's syndrome and that of undetermined cause, believed in most of the cases to be of central or general origin.

We have records of 87 cases; on 17 of these we have no final reports. For statistical purposes we are classifying the latter group as failures even though possibly some of the patients were cured by one treatment. Forty-seven cases are classified as instances of Ménière's disease, by which we mean that the lesion was peripheral and noninflammatory. In 15 of these the patients had previously been treated by restriction of salt intake, dehydration and administration of ammonium or potassium chloride, without improvement, but responded to the administration of pyridoxine. There have been 3 complete failures among those whom we were able to follow up, and there were a number who were not sufficiently prompt in response, so that the question of spontaneous recovery must be considered. A few had recurrences of vertigo on stopping treatment, and the symptom disappeared on reinstatement of pyridoxine.

An interesting observation made by one of us (Dr. Fox) in several of his cases diagnosed as instances of Ménière's syndrome was the zigzag appearance of the audiogram of the affected ear. This may help in establishing that the lesion is peripheral. The graph smoothed out at the higher level after treatment. In general, although we have as yet made no statistical study of this point, it does not appear that the hearing was improved in any such proportion of cases as was the vertigo. The presence of vertigo without loss of hearing or other evidence of

Read before the Chicago Laryngological and Otological Society, Nov. 3, 1947.

peripheral disturbance and without otoneurologic evidence of a central lesion, such as postural nystagmus, is considered suggestive of a general cause, toxic, vasomotor or allergic.

A few interesting cases may be briefly described:

Mrs. R., aged 70, had multiple diverticula and had undergone at least one episode of pyelitis. She was unable to walk or stand without holding on. Neurologic tests gave negative results except for the Romberg sign. She was not helped by restriction of salt and fluid or by administration of nicotinic acid. Audiometric examination showed inner ear deafness, senile type. Pyridoxine relieved her of instability to the point that she could walk alone, but she was not entirely cured.

W. S., 30 years old, with good health previously, was seized with sudden vertigo, vomiting and diarrhea; there was no tinnitus; the hearing was normal; postural nystagmus was noted with all positions of the body, including head hanging; the Kahn test and the routine examination of the blood gave negative results; an examination of the spinal fluid made elsewhere was reported to have shown no abnormality. A provisional diagnosis of a cerebral accident or of a vascular spasm occurring in the region of the vestibular nuclei was made. Pyridoxine, 100 mg. of the hydrochloride injected intravenously, stopped the vertigo but did not entirely control the nausea, which gradually subsided under further treatment in which 50 mg. of pyridoxine hydrochloride was administered by mouth twice a day.

Mrs. Q. was under treatment by a cardiologist when disabling vertigo supervened without abnormal otoneurologic findings. Pyridoxine hydrochloride was taken by mouth at the rate of 25 mg. three times a day. After two weeks, the patient returned to the cardiologist, who reported, "She is a new woman. What did you give her?"

J. G., aged 56, suffered an attack of dizziness, vomiting and diarrhea. Two months later he was still dizzy on movement and noted low pitch tinnitus. He had stopped drinking alcoholic liquors and coffee. He had been treated by three physicians but dizziness persisted. Two years prior to this attack he had a similar one which lasted two weeks. Several years prior to examination he received antisyphilitic treatment. Recent examinations of his spinal fluid and blood were reported to have given negative results; the red cells numbered 4,500,000 per cubic millimeter; the white cells, 6,500; the hemoglobin content was 12 Gm. per hundred cubic centimeters. There was a definite imbalance in the after turning test; there was marked imbalance in the caloric nystagmus but no spontaneous or postural nystagmus. Whisper was heard in the right ear at 2 feet (0.5 meter) and in the left ear at 6 feet (about 2 meters). The ocular fundi were normal, but there was amblyopia exanopsia of the right eye. The diagnosis was: a peripheral lesion (Ménière's disease). Pyridoxine hydrochloride, 50 cc. injected intravenously, stopped the vertigo for eight hours, after which his physician at my suggestion prescribed 25 mg. to be taken four times a day. He returned to work within three weeks.

The pyridoxine treatment has several advantages. It requires no hospitalization; in fact, it can be administered entirely by mouth, although we frequently begin with an intravenous injection for quick effect; it does not distress the patient as does the dehydration, saft-free diet method, nor does it necessitate taking so many large capsules. Side effects have been practically nil in our experience, but in one of the small advertising brochures there has been a report of a death, attributed to anaphylaxis, the patient having been sensitized by a previous intra-

venous injection. We have been unable to locate the original report. Our average dosage has been 100 mg. a day given in divided doses, usually by mouth. The entire dose of 100 mg. may be given intravenously.

Whether or not this treatment will prove itself, after greater experience, to be as efficacious as other methods of treatment remains to be seen. These cases were collected from private practice over a period of two years and lack any system of controls except that offered by clinical experience.

We realize that treatment should be based on the removal of the causative factor, if it can be determined and controlled. When this goal cannot be fully achieved, the pyridoxine should be of help.

25 East Washington Street.

VITAMIN P IN RHEUMATIC EPISTAXIS

I. NEWTON KUGELMASS, M.D., Ph.D., Sc.D.
NEW YORK

NONTRAUMATIC, nonirritant nosebleed is an early manifestation of rheumatic fever, especially in the presence of active heart disease. It may herald the onset of an acute attack, forewarn of an exacerbation of rheumatic activity or develop in a patient convalescing from active carditis. A single severe attack usually gives way to repeated episodes, increasing in frequency and severity with age and rheumatic activity. Bleeding usually arises from Little's or Kiesselbach's area, situated in the highly vascular anterior portion of the nasal septum, although other sites may be affected. Most of the rheumatic children either showed partial organization of the clot, with subsequent ulceration of the nasal septum, or, more often, a visual source of bleeding. Repeated hemorrhages may be so severe and the concern so great that cauterization and transfusion become necessary.

Hemorrhagic phenomena accompany rheumatic fever during periods of activity. There may be repeated epistaxis, easy bruising on slight injury, occasional frank

Effect of Vitamin P on Capillary Resistance

	Normal Children		Rheumatic Children		
Age, Yr.	Number	Capillary Resistance, Mm. Hg	Number	Capillary Resistance Before Vitamin P, Mm. Hg	Capillary Resistance After Vitamin P, Mm. Hg
6-8	28	250-300	18	120-180	200-240
8-10	25	200-250	26	100-150	140-170
10-12	30	180-200	29	80-120	130-150
12-15	24	160-180	30	75-100	120-140

hematuria, purpuric spots late in the course of widespread infection, blood-stained exudate in rheumatic pericarditis and hemorrhage in any part of the body.[1] The early inflammatory tissue changes are due to engorgement of blood vessels and increased permeability of their walls. But blood-clotting components remain normal. Since epistaxis is the most prominent hemorrhagic symptom of rheumatic fever, occurring in about one third of the cases observed by me, it was amenable to clinical study. With increased vascular fragility of the nasal mucous membrane as a determining factor of rheumatic epistaxis, I tested the value of vitamin P in controlling nasal hemorrhage without resorting to local or systemic hemostatic measures.

Capillary resistance was determined by the positive pressure method[2] during bleeding episodes and at weekly intervals following vitamin P therapy. This consisted of 250 mg. tablets of eriodictyol, derived from lemon rind, the richest

1. Kugelmass, I. N.: Clinical Control of Chronic Hemorrhagic States in Childhood, J. A. M. A. **102**:204 (Jan. 20); 287 (Jan. 27) 1934.

2. Kugelmass, I. N.: Vitamin P in Vascular Purpura, J. A. M. A. **115**: 519 (Aug. 17) 1940.

source, or 5 mg. capsules of the chalcone.[3] One or more doses were offered with meals for several weeks, depending on the therapeutic effect gaged qualitatively by episodes of epistaxis and quantitatively by capillary resistance measurements. The extent to which capillary resistance rose above the critical level for bleeding varied with age and degree of rheumatic involvement. But these values were below the norms already established for various age levels in previous controls for studies of hemorrhagic disease. The rheumatic children showed a striking diminution in both frequency and severity of nosebleeds and a marked increase in the tendency toward spontaneous arrest of the nasal hemorrhage. Vitamin P therapy, of course, supplemented various measures used in the management of rheumatic fever with and without accompanying involvement of the heart. In view of the role of certain nutrients in the maintenance of vascular integrity, i.e., amino acids, thiamine and pyridoxine,[4] I formulated an adequate diet for each child reenforced by massive doses of vitamin concentrates.[5]

SUMMARY

Nontraumatic, nonirritant nosebleed occurred in about one third of rheumatic children observed over a period of fifteen years. It is due to increased vascular fragility of the nasal mucous membranes, marked during puberty and prevalent during active carditis.

Vitamin P derived from lemon rind and administered as tablets of eriodictyol or capsules of the chalcone increased capillary resistance above the critical level for bleeding but not to the normal level; nevertheless, it diminished the frequency and severity of rheumatic epistaxis.

3. Hesperidin chalcone was provided by Eli Lilly and Company.

4. Kugelmass, I. N.: Blood Disorders in Children, New York, Oxford University Press, 1941.

5. "Synbefax" (thiamine hydrochloride 10 mg., riboflavin 5 mg., nicotinamide 50 mg. and ascorbic acid [vitamin C] 75 mg.) was provided by Lederle Laboratories, Inc.

Progress in Otolaryngology

Summary of the Bibliographic Material Available in the Field of Otolaryngology

ALLERGY

E. L. MacQUIDDY, M.D.
AND
R. E. KING, M.D.
OMAHA

MILITARY ALLERGY

THERE has been a high incidence of allergy among military personnel of overseas theaters. Of the allergic manifestations encountered, bronchial asthma has been a major offender. Leopold,[1] in a study of the first 200 asthmatic patients returned from theaters overseas and admitted to the allergy service of a large Army hospital, found that 91.5 per cent of these patients had experienced manifestations of their asthma while in the tropics; 68.5 per cent gave a history of having had bronchial asthma before entering the Army. This group was composed of young men, white and Negro, between the ages of 19 and 45 years. An analysis of the history of the onset in the new cases and of the recurrence of symptoms in the old cases showed that the asthma was conditioned by three factors, namely, climate, dust and infection. By "climate" is meant either high humidity with high temperature or cold damp weather. Psychogenic factors were considered, and in no instance were they found to be of etiologic significance. The author considered that the climate of high humidity with frequent rain was a significant factor of the onset and continuation of chronic, perennial bronchial asthma. The dust obtained from barracks bags returned from the South Pacific area did not contain an identifiable antigen when used in skin tests made on soldiers who had become asthmatic while in the South Pacific theater. Skin reactivity was just as great when ordinary house dust was used.

Rudolph[2] reports on 200 cases of bronchial asthma occurring in military personnel observed in the allergy section of the Oliver General Hospital. Ninety per cent of these soldiers were between 20 and 35 years of age, and 85 per cent had the onset of their asthma prior to

1. Leopold, H. C.: Study of Asthmatics Returned from Overseas, J. Allergy **16**:30-43, 1945.

2. Rudolph, J. A.: The Study of Bronchial Asthma in a General Hospital with a Statistical Report of Two Hundred Cases, Ann. Allergy **3**:258-270, 1945.

military service. Fifty-four per cent had an overseas onset or aggravation of their symptoms, and 92 per cent had associated allergies. Sixty-seven and one-half per cent gave a family history of allergy. Seventy-nine per cent had less than two and one-half years of service prior to their disposition, and 61 per cent were discharged on a certificate of disability. Twenty-three and one-half per cent were returned to limited duty, while only 11.5 per cent were returned to full duty.

Allergic rhinitis has also caused a considerable loss of time and of efficiency among members of the armed forces. Blank and Levitt [3] report that among military personnel seen at the allergy clinic at Fort Eustis, Va., from June 1, 1941 to Dec. 21, 1943 the incidence of allergic rhinitis was 6.3 per thousand men. During that time 741 cases of allergic rhinitis were observed at the allergy clinic. This total is much lower than is usually quoted as the incidence of allergic rhinitis, because many of the men with the more severe forms of this disease are rejected for military service by the induction boards, and many of those with the milder forms do not report for treatment or are not recognized as allergic.

Forty-one per cent of these cases of allergic rhinitis were clinically uncomplicated cases of fall hay fever due to ragweed pollen. Of these 303 cases, 100 were instances of marked or moderate sensitivity to ragweed alone, while 193 were instances of moderate or marked cutaneous sensitivity to other inhalants. Twenty-two cases of fall hay fever were complicated by evidence of perennial rhinitis. Thirty-nine cases were complicated by asthma, while histories and findings of both grass and ragweed hay fever with a period of relief between attacks were recorded in 60 cases. Grasses were responsible for 75 cases of summer hay fever. The incidence of multiple cutaneous sensitivities was greater in this group than in the ragweed group, and more complications, such as perennial rhinitis and asthma, were also noted in the summer hay fever group. Although the grass hay fever was clinically milder than the ragweed hay fever, it represents a more difficult problem to the overseas forces because of the more universal distribution of grasses and the higher incidence of complications in the group suffering from it.

Spring fever due to trees was seen in only 1 case, a case of oak sensitivity combined with grass sensitivity.

One hundred and fifty-five cases of perennial rhinitis were seen, 12 of which were due to foods and the rest to inhalants only. In all these cases roentgen studies of the sinuses were made and in all but 20 cases pathologic change of the sinuses was evidenced by thickening of the mucous membranes, or hypertrophic sinusitis. Some degree of polyposis was observed in 32 cases.

3. Blank, P., and Levitt, H.: Military Aspects of Allergic Rhinitis, Ann. Allergy **3**:113-123, 1945.

The authors also discuss the worldwide occurrence of pollen. In military as well as in civilian practice the etiologic diagnosis of hay fever requires a knowledge of the pollen to which the patient is exposed.

The treatment employed in these cases of allergic rhinitis consisted of elimination of the allergen, desensitization and local treatment. Military therapy often differs from civilian in cases of allergy, because elimination procedures are often difficult, if not impossible, and desensitization routines may be impracticable. Local therapy is sometimes efficacious and will usually suffice to give the soldier relief until he is evacuated.

Because of the high incidence of allergic conditions of the respiratory tract encountered at an Army Air Forces hospital at San Antonio, Texas, Hampton and Lowe [4] studied the relationship of atmospheric mold spores and the allergic state in persons suffering from hay fever, vasomotor rhinitis and bronchial asthma. It seems probable that these spores act as other air-borne allergens in producing allergic symptoms, although their exact role in the causation of allergic diseases has not been definitely established. Fifty-seven of 358 patients with allergic disease and none of 92 "nonallergic" persons showed marked reactions when tested intracutaneously with extracts of atmospheric molds (Alternaria, Hormodendron, Spondylocladium and Helminthosporium). Alternaria evoked reactions in 55 of the 358 patients with various allergic diseases; Hormodendron, in 21 of 301 persons tested intracutaneously as a routine procedure. Sixteen of the 57 patients reacted to mold extracts alone; 32, to pollen extracts, and 21, to inhalant extracts. Four did not react to food extracts. Of the 57 patients having positive skin reactions on being tested with mold extracts, 54 had respiratory allergy. Forty-seven of 54 persons reacting to mold extracts had eosinophils in their nasal secretions.

Hormodendron excited skin reactions in the least incidence of all four mold extracts even though it was found to be the most common atmospheric mold encountered by colony count in a survey of atmospheric mold spores.

No attempt was made to evaluate mold extracts as used in the treatment of allergic disease of the respiratory tract.

EAR, NOSE AND THROAT

Discussing nasal allergy for the practicing rhinologist, Shambaugh[5] states that at least 90 per cent of chronic nasal infections can be shown

4. Hampton, S. F., and Lowe, E. P.: Air-Borne Fungi in Allergic Disease: I. A New Method of Preparation of Mold Extracts; Incidence of Skin Reactions with Mold Extracts, J. Allergy **16**:101-108, 1945.

5. Shambaugh, G. E., Jr.: Nasal Allergy for the Practicing Rhinologist, Ann. Otol., Rhin. & Laryng. **54**:43-60, 1945.

to have an underlying allergic factor which is responsible for the chronicity. In its early stages nasal allergy is a reversible reaction, so that after the hay fever season the edematous mucous membrane of the nose usually returns to normal. However, if the hay fever is severe, polypi may persist in the ethmoid cells long after the pollen has left the air. The allergic reaction appears to lower the resistance of the tissues to infection, and secondary infection is prone to occur in the chronically allergic nose. This results in hyperplastic and polypoid changes of the nasal and sinal mucosa requiring in many cases surgical removal of nasal polypi and of mulberry posterior tips of the inferior turbinates and occasionally removal of a hyperplastic infected sinal mucosa. Surgical operation must be combined with allergic management to effect sustained relief in these cases.

With regard to the diagnosis of nasal allergy, Shambaugh [5] states that frequent head colds, or the prolongation of an ordinary head cold, and chronic nasal infection should cause one to suspect nasal allergy. Periodic headache is also a frequent and characteristic symptom of nasal allergy, as are hay fever, asthma, distress after eating, food idiosyncrasies, eczema and urticaria. The typical nasal mucosa of the allergic person is pale and edematous, with an increased amount of clear watery or mucoid secretion. Nasal polypi and polypoid and hyperplastic changes occurring in the turbinates are almost always on an allergic basis. Tenacious mucus filling the inferior meatus is a characteristic finding of nasal allergy.

The allergic history is one of the most valuable aids when one is diagnosing the specific allergen responsible for the nasal allergy and, according to the author, is often of more value than the cutaneous tests. Inhalant allergens usually give seasonal symptoms or symptoms that are improved by a trip away from home. House dust usually gives nasal symptoms that are better in summer, worse with cold weather and steam heat, worse indoors than outdoors and worse when dust is stirred up but are improved by a trip to the South during the winter.

Nasal symptoms due to food allergy are not usually affected by season, climate or locality, because the diet of the average person remains fairly constant, but they may be associated with gas and distress or headaches after eating.

Cutaneous tests, although an aid, cannot be relied on solely as a means of diagnosis. When the allergen is an inhalant, such as a pollen, a fungus, house dust, feathers or orris root, the cutaneous test is relatively accurate and reliable, but it is reliable in only about 30 per cent of the cases of food allergy. Shambaugh states that a large number of tests of the skin are not necessary in every case of nasal allergy. Usually 20 to 50 tests are sufficient for diagnosis.

When food is the etiologic factor of nasal allergy, the diagnosis of the specific allergen is based largely on an elimination diet. This is a basic diet that eliminates all the foods commonly causing allergy, such as wheat, eggs and milk. It is sufficient to restrict the patient to the diet during a trial period of one to two weeks. When removal of a specific substance or treatment with an extract of it results in disappearance of the symptoms, and when subsequent exposure to the substance again produces the symptoms, this allergen may be regarded as being responsible for the nasal allergy regardless of whether the skin test is positive or negative.

Shambaugh further states that house dust is a major factor in at least 90 per cent of all cases of chronic nasal allergy (excluding hay fever). Good results are obtained in the treatment of nasal allergy due to house dust by injecting small doses of house dust extract, provided the proper dosage is used. The chief difficulty is in determining the optimum dose of the extract for the individual patient, because this varies widely, but usually the dose is very small. The injections are given at the rate of one a week, and the dose is slowly increased (or decreased in case of a reaction) until the symptoms are relieved. That size dose can then be regarded as optimum for that patient and is given every three weeks until warm weather arrives. One must remember that the allergic patient may be sensitive to a number of substances but that only one or two of these will be chiefly responsible for his symptoms. Removal of these substances or treatment for the sensitivity will relieve the symptoms.

Paterson [6] describes vasomotor rhinitis as a "localized nasal mucous membrane manifestation of a general nervous imbalance." The number of cases of vasomotor rhinitis greatly increased during the war, a phenomenon which he attributes to the effect of worries, frustrations and disturbed living conditions. In order to institute proper treatment, a study must be made of the patient's mental state, endocrine disturbances and allergic tendencies. While studying the patient to learn the basic cause of his vasomotor rhinitis, one may use various forms of local treatment of the mucous membranes. The author found the 0.25 per cent solution of "neo-synephrine" hydrochloride to be most satisfactory in the majority of cases. As a rule, radical surgical treatment is not indicated. Psychotherapy is important in the general treatment of vasomotor rhinitis. Administration of glandular substances is indicated in certain cases, especially if the patient is a woman with definite evidence of estrogen deficiency, and in cases in which the use of thyroid is indicated. Histamine phosphate injection U.S.P., given hypodermically, is of value in most cases and should be tried. Selective vaccines should be employed if a definite infection is present.

6. Paterson, W. P. E.: Vasomotor Rhinitis, Canad. M. A. J. **52**:400-405, 1945.

A type of borderline nasal allergy has been described by Fox and Kesel.[7] This is a condition which occurs in patients with a family history of allergy or who have had other allergic manifestations. The patient reveals sensitivity to a particular protein and responds to hyposensitization with this protein. The syndrome consists of nasal obstruction, especially bad during the sleeping hours, and intumescence, associated with postnasal drip and intrapharyngeal accumulation of mucus. Patients of this type respond to proper hyposensitization based on recognition of the offending allergen. The chewing of a gum tablet containing 0.25 Gm. of sulfathiazole for one hour four times a day will reduce the Streptococcus salivarius count, and the fetor oris disappears.

Fabricant [8] discusses the relation of the hydrogen ion concentration of nasal secretions in situ and the activity of lysozyme. Lysozyme, a substance found in various body tissues and secretions, especially nasal secretions, has the property of dissolving certain bacteria. This substance is especially active in an acid environment and, although it is most active against nonpathogenic organisms, it can attack pathogenic organisms as well. The hydrogen ion concentration of the nasal secretions present in normal nasal passages varies from p_H 5.5 to p_H 6.4. Those secretions become alkaline during acute rhinitis and the active phases of allergic rhinitis. The author measured the hydrogen ion concentrations of nasal secretions in various pathologic nasal states. Fluctuations of the hydrogen ion concentration of the nasal secretions affected the bacterial flora of the nose and sinuses. Negative nasal cultures are usually observed at p_H 6.5 or less, whereas on elevation of the p_H value, with the nasal mucosa becoming alkaline, bacterial growth usually appears. Eosinophils, also, disappear from the nasal secretions when the p_H is on the acid side and reappear as the p_H returns to the alkaline side.

Cahn-Bronner [9] found that lysozyme disappeared or decreased heavily during the first two to four days of the common cold. Nasal discharges of patients with hay fever showed high lysozyme content.

Parkinson,[10] on the other hand, does not agree that nasal secretions shift markedly toward the alkaline side in various pathologic conditions.

---

7. Fox, N., and Kesel, R. G.: Hyperplastic Sinopharyngostomatitis: A Manifestation of Borderline Allergy Resulting in Fetor Ex Oris, Snoring, Globus Hystericus, Arch. Otolaryng. **42**:368-371 (Nov.-Dec.) 1945.

8. Fabricant, N. D.: Relation of the p_H of Nasal Secretion in Situ to the Activity of Lysozyme: Report of a Case of Experimentally Induced Allergic Rhinitis, Arch. Otolaryng. **41**:53-55 (Jan.) 1945.

9. Cahn-Bronner, C. E.: The Presence and Action of Lysozyme in the Nasal Mucosa, Ann. Otol., Rhin. & Laryng. **51**:250-252, 1942; cited by MacQuiddy, E. L.: Allergy, Arch. Otolaryng. **39**:189-193 (Feb.) 1944.

10. Parkinson, S. N.: Determinations of Intranasal p_H: A Discussion and Criticism, Arch. Otolaryng. **41**:68-70 (Jan.) 1945.

He states that in the nasal chambers there are two distinct sources of hydrogen ion concentration, living tissue and nonliving secretion. Present methods of measuring the hydrogen ion concentration of either nasal secretion or nasal mucous membrane in situ have not been practicable, because secretion and membrane are so intimately associated that an indicator placed intranasally is certain to contact both of them and thus give an "intranasal" p_H, a combined value. All living tissues are perfused with body fluid having almost constant physical properties. The physical properties of secretions and excretions found on body surfaces are uncontrolled and continually changing. The properties of nasal secretions change continually under the influence of many environmental factors, and these changes cannot be interpreted as necessarily purposeful. They indicate, if anything, the tolerance of the nasal membrane to change in external environment. Intranasal treatment is not a treatment of nasal secretions but of the mucous membrane. It is therefore important that solutions for nasal therapy be designed with the physical structure of tissue fluid as a guide rather than that of nasal secretion.

Imbalance of the endocrine glands may be an etiologic factor in certain cases of vasomotor rhinitis. Laub [11] states that symptoms of vasomotor rhinitis may occur at the time of adolescence, during the climacteric in both men and women and during the eighth decade. The administration of small doses of testicular or ovarian extract was found to improve the condition. Disturbances of the thyroid, the parathyroid or the pituitary gland may result in vasomotor rhinitis. In the treatment of these conditions, a careful history, a basal metabolism test (repeated after the ingestion of protein) and trial treatment aid in determining the gland involved.

The author discusses 4 cases of vasomotor rhinitis, 2 in which there was concomitant asthma, to illustrate the excellent results obtained with glandular therapy.

In a discussion of nasal medication with regard to sinusitis, Tremble and Smith [12] state that much attention has been given recently to the p_H value of nasal secretion. The p_H value indicates that normally the intranasal surfaces are slightly acid and that they become alkaline during acute colds and infection. Rest and heat tend to reduce alkalinity, and this is more marked at night than during the day. It is sometimes difficult to persuade a patient to remain in bed in the early stages of acute rhinitis or sinusitis, but theoretically this appears advantageous. The organisms most frequently isolated from the nose in acute coryza and nasopharyngi-

11. Laub, G. R.: Rhinitis Vasomotoria Due to Imbalance of the Endocrine Glands, Laryngoscope **55**:179-186, 1945.

12. Tremble, G. E., and Smith, F.: Nasal Medication in Sinusitis, Canad. M. A. J. **53**:564-568, 1945.

tis are beta hemolytic streptococci, pneumococci and Hemophilus influenzae, although the predominating organism varies from year to year. The secondary invaders which produce sinusitis and aural complications, streptococci, staphylococci and pneumococci, are controlled by chemotherapy. It is doubtful whether nasal instillation of a 5 per cent solution of sulfathiazole sodium is as beneficial as it is in the treatment of otitis. Powdered sulfathiazole, sulfadiazine and the microcrystals in 5 per cent saline solutions do not appear to exert any destructive action on the cilia or the nasal mucosa. However, the author states that for nasal medication solutions should be isotonic and slightly acid, with p_H between 5.5 and 6.5.

The author stresses the advantages of the local use of antibiotics as compared with the use of the sulfonamide drugs. Penicillin and gramicidin have few disadvantages. Gramicidin is effective against many of the gram-positive organisms, such as Pneumococcus and some forms of Streptococcus and Staphylococcus; however, it is toxic when injected intramuscularly or intravenously and must be used as a topical application. It is insoluble in water and must be in direct contact with the organism to be at all effective. It is prepared in a 2 per cent solution in sterile distilled water, and this solution is said to remain active for at least three weeks, provided the invading organism is sensitive to gramicidin. Penicillin has a wider range of usefulness than gramicidin. It is soluble in water, is quite innocuous even in large doses and may be used locally or injected intramuscularly, intravenously or intrathecally or taken orally. In proper dilution it is nonirritating to mucous membranes and does not injure the ciliated epithelium of the nose. Although it is usually stated that solutions of penicillin must be fresh, that they lose their effectiveness after a week or ten days and must be kept at low temperatures, the author occasionally kept solutions of penicillin for two weeks at room temperature and found them still effective when used to destroy hemolytic streptococci. The time required for penicillin to sterilize pus when used by the displacement method varies according to the organism. Pneumococci and hemolytic streptococci are very sensitive and are destroyed in about forty-eight hours. Staphylococcus pyogenes, on the other hand, is more resistant and requires ten days to two weeks to clear a cavity of this organism. Fluid instilled into the nose by the displacement method remains in the sinuses from twenty-four to ninety-six hours or longer. The author used penicillin by the displacement method every forty-eight hours for four to ten treatments, depending on the organisms present. Sinus infections in which the offending organism was Staph. pyogenes, pneumococci or streptococci and which were not complicated by allergic manifestations have responded readily to this form of treatment.

EYE

The Vogt-Koyanagi syndrome refers to a condition of bilateral uveitis associated with any one or all of the following signs: alopecia, poliosis, vitiligo and dysacusia. This disease has a protracted course, responds poorly to treatment and usually terminates in partial or complete blindness. According to Rosen,[18] it has been described in ophthalmic literature forty-seven times, but whether the cases described could be classified as instances of the Vogt-Koyanagi syndrome or instances of the usually benign Harada disease has not been clear. Rosen presents a case with the purpose of drawing some conclusions about the nature and the course of this syndrome and to suggest a method of treatment:

> The patient was a 24 year old Puerto Rican residing in New York. He came to the ophthalmologic clinic in February 1943, complaining that vision was blurred in both eyes. He had been wearing glasses for six months, which apparently had not increased his vision. His difficulties with his eyes began in 1938 when he became aware of difficulty in reading newspapers and books. There was no blurring of distant vision. He was treated for a month by his family doctor. "Eye drops" and some form of internal medication were prescribed. At the end of this time no improvement was noted, and the patient consulted an ophthalmologist, whose diagnosis was bilateral uveitis. Internal medication, eye drops and hot compresses were used for six weeks. Vision was much improved, and the patient discontinued medication. One year later he had a second attack, which was more pronounced in the right eye than in the left. After several weeks his eyes began to clear up without medication, although not completely. In the spring of 1942 the patient again noticed gradual blurring of vision in the left eye. The dimness of vision did not clear up this time but became steadily worse during the summer months. In none of these attacks was the onset accompanied by any acute symptoms, such as nausea, vomiting, headache or fever. At no time had there been pain of any type or dizziness, tinnitus, deafness, lassitude, anorexia, stiffness of the neck or febrile reaction.
>
> At the time the author examined the patient, it was noted that the patient had dark hair with the exception of two regions on the occipital prominences which were covered with symmetric patches of white hair. There were some small white eyelashes on each of the lids. Examination of the skin of the back, shoulders, chest and arms showed several small depigmented islands, none of which was more than 10 mm. in its greatest diameter.
>
> Among the ophthalmologic findings, the appearance of the eyegrounds was of especial interest. In each eye the background of the fundus was a peculiar light orange color, giving off a glowing effect. Certain areas were relucent, with the light passing through the eye proper as in albinism. In the right eye the nerve was elongated vertically and was rectangular rather than oval. There was depigmentation in the region of the retinal pigment at the papilla, the nerve appearing to blend into the surrounding tissue. There were regions of scleral atrophy surrounding the nerve head which were slightly whiter than the portion of the nerve head adjacent to them but blended into the optic nerve with slight demarcation. In the macular region there were several round and oval, slate-colored, pigmented lesions varying in size from ⅛ to ⅓ disk diameter. These were closely packed together, with some suggestion of overlapping. The periphery of each eyeground was

13. Rosen, E.: Uveitis, with Poliosis, Vitiligo, Alopecia and Dysacousia (Vogt-Koyanagi Syndrome), Arch. Ophth. **33**:281-292 (April) 1945.

much darker than the paracentral region. There were many small grayish lesions scattered throughout the periphery in an incomplete girdle. The choroidal vessels were visible as a striking feature through the structure of many of these lesions.

An examination of the blood, the urine and the spinal fluid gave entirely negative results.

The patient was referred to the allergy department, where his history was carefully inquired into, with special emphasis on sensitivity to horse serum. When tested with concentrated horse serum, the patient showed a 4 plus reaction. He was desensitized to horse serum over a period of weeks, small doses being given initially and gradually increasing doses later. Desensitization was begun May 5, 1943. The patient's vision had constantly decreased since his being in the hospital and at this time was 20/800 in each eye. On July 1, 1943 it was noted that the right eye was beginning to respond to therapy. Vision was now 20/70 in the right eye and 20/100 in the left unimproved by glasses. By the early part of September the vision of the right eye had been corrected to 20/20 and that of the left eye to 20/25.

As to the etiologic explanation of the Vogt-Koyanagi syndrome, the author, after reviewing previous cases reported, concluded that the pathologic process was probably an allergic one in which the immune response was almost nonexistent except when stimulated, whereas in Harada's disease a condition of immunity soon develops in consequence of a severe allergic reaction.

Uveitis not only is caused by syphilis, tuberculosis, direct injury and focal infection but, according to Gill,[14] in many cases is due to food allergies or to vitamin deficiencies. In each case it is important to determine the exact etiologic factor because with each type the treatment differs and the successful outcome depends largely on the selection of proper medication. Sensitization develops early in uveitis, and in nearly all cases of posterior uveitis due to focal infection the patient is sensitive to uveal pigment. This sensitivity represents only a phase of the disease. It may be diagnosed by making intradermal tests with uveal pigment. Lenticular changes of a cataractous nature develop in many cases of protracted posterior uveitis but usually only after a period of years. In cases of uveitis of allergic origin and due to ingestion of certain foods, skin tests and elimination diets may serve to disclose the offending substance. Deficiencies of vitamins A and D render the patient more susceptible to such attacks. Elimination of the offending food or foods and administration of vitamins are recommended. Calcium is indicated in cases of this syndrome because it limits exudation. It may be supplemented by internal administration of desiccated parathyroid gland, 1/16 to 1/20 grain (4 to 3 mg.) three times a day, or parathyroid extract, 0.5 cc. four times a day by hypodermic injection. Desensitization should be attempted in all cases in which cutaneous tests made with uveal pigment show positive reactions.

14. Gill, W. D.: Uveitis and Its Relation to Focal Infections and Allergy: Some Observations Concerning the Diagnosis, Prognosis and Treatment of the Several Clinical Types, Texas State J. Med. **40**:488-491, 1945.

PERIARTERITIS NODOSA

Periarteritis nodosa has been known to affect the eye. Sampson [15] describes a case in which the choroidal arteries were severely affected and the retinal and ciliary vessels only slightly affected. The exudative phase of the choroidal arteritis could be observed ophthalmoscopically in the absence of albuminuric retinopathy. The patient was a 20 year old airman. No cause was found; however, no allergy studies were made.

Rich [16] observed periarteritis nodosa in a 56 year old Negro man who had become sensitized to iodine. It is known that a nonantigenic chemical substance can be united to a protein and then becomes able to stimulate the formation of antibody that reacts specifically with the chemical substance. It has been shown that the serum sickness type of protracted anaphylactic reaction arising in persons hypersensitive to foreign serum and to sulfonamide compounds can cause periarteritis nodosa. Since sulfonamide compounds attach themselves readily to human plasma protein and become able to sensitize and cause periarteritis nodosa, it may be expected that periarteritis nodosa will also result from hypersensitive reactions arising when the body becomes similarly sensitized to other drugs and chemical substances.

Rich [17] describes several cases in which periarteritis nodosa developed following sulfonamide-plus-serum, serum or iodide therapy. He suggests that the lesion may begin as a wheal of the arteriolar wall, leading to necrosis when the local edema interferes with nutrition, because the earliest pathologic change of periarteritis nodosa is focal edema of the intima and the underlying media of the vessel wall. He also suggests that rheumatic fever is due to hypersensitiveness. Hemolytic streptococci may be the common antigen, with other organisms at times acting as stimuli. He further suggests that the familial incidence of rheumatic fever may be based on hereditary immunologic predisposition.

HISTAMINE

Dragstedt,[18] in considering whether histamine is of significance in anaphylaxis, states that this is a much discussed matter which has never been settled beyond dispute. Histamine is responsible for diverse disturbances, and it has never been isolated in crystalline form in associa-

15. Sampson, R.: Periarteritis Nodosa Affecting the Eye, Brit. J. Ophth. **29**: 282-288, 1945.

16. Rich, A. R.: Hypersensitivity to Iodine as a Cause of Periarteritis Nodosa, Bull. Johns Hopkins Hosp. **77**:43-48, 1945.

17. Rich, A. R.: The Role of Hypersensitivity in the Pathogenesis of Rheumatic Fever and Periarteritis Nodosa (Lewis Linn McArthur Lecture), Proc. Inst. Med. Chicago **15**:270-280, 1945.

18. Dragstedt, C. A.: The Significance of Histamine in Anaphylaxis, J. Allergy **16**:69-77, 1945.

tion with anaphylactic phenomena. However, its effects mimic many of the important anaphylactic reactions, and it is present in the tissues where these reactions take place. Histamine is released by the tissue as one of the consequences of antigen-antibody reaction. The mechanism by which this release is brought about is not known, nor is it known whether this release is of major or of minor importance. In those cases that have been studied most thoroughly, histamine has been of the utmost importance.

The intracutaneous histamine test is of no value as a general indicator of allergy. Farmer [19] employed for intracutaneous testing 0.01 mg. of histamine phosphate contained in 0.05 cc. of isotonic solution of sodium chloride. The test was made on 86 persons, 77 of whom presented the clinical picture of allergy and 65 of whom had positive reactions in specific skin tests. Only 12 of the latter group showed a positive reaction to histamine according to Atkinson's terminology.

Benson and Horton [20] have studied the effects of continuous intravenous administration of histamine on the blood pressure and the pulse rate. They administered a 1:250,000 solution of histamine diphosphate by the intravenous drip method at the rate of 120 to 150 drops per minute. During administration of the drug the pulse rate increased from 23 to 39 per minute and there was a slight but definite drop in the diastolic blood pressure. The blood pressure and the pulse rate returned to their original level within ten minutes after administration of the drug was discontinued. Approximately the same effects were observed, irrespective of the number of intravenous injections of histamine which a given patient received.

Chronic histamine stimulation may be the etiologic factor of peptic ulcer in certain cases. Alford and Whitehouse [21] describe a case of histamine cephalalgia; the gastric acidity curve was predominantly low, but during attacks of headache it was high, similar to the curve resulting from injection of histamine phosphate.

The patient was treated with injections of histamine phosphate. Prior to and during this treatment ulcer therapy was instituted, with frequent milk and cream feedings, a bland, low roughage diet, aluminum hydroxide gel and rest. The headaches and the ulcer crater both disappeared, with no change in the essential gastric secretory mechanism. There was no apparent change in the responses made by the gastric secretory apparatus to injected histamine following "desensitization."

---

19. Farmer, L.: Evaluation of the Histamine Intradermal Test as a General Indicator of Allergy, J. Allergy **16**:44-47, 1945.

20. Benson, A. J., and Horton, B. T.: Effects of Continuous Intravenous Administration of Histamine on the Blood Pressure and Pulse Rate in Cases of Multiple Sclerosis, Proc. Staff Meet., Mayo Clin. **20**:113-119, 1945.

21. Alford, R. I., and Whitehouse, F. R.: Histamine Cephalalgia with Duodenal Ulcer, Ann. Allergy **3**:200-203, 1945.

EOSINOPHILIA

Mansmann [22] has again emphasized the diagnostic value of the eosinophil as observed in allergic states. Case histories of allergic states are presented together with the clinical and laboratory observations. The recognition of the eosinophils present in involved tissues may serve in diagnosing the condition to be of allergic origin. More extensive use of smears and eosinophil counts is of definite aid.

A case of tropical eosinophilia is reported by Hirst and McCann.[23] In all previously reported cases the condition had occurred or originated when the patient was in the coastal areas of India, but this patient had never been in India. The typical syndrome, which is characterized by a gradual onset, with malaise, loss of weight, slight elevation of temperature, a paroxysmal type of dry hacking cough and physical signs like those of bronchial asthma, was seen in this case. No etiologic factor could be demonstrated. After the patient had spent several weeks in the hospital, the chronic stage was reached, the loss of weight stopped, but the paroxysms of coughing and wheezing continued. The white blood cell count was 15,520, of which 16 per cent were polymorphonuclear and 72 per cent eosinophilic. Cutaneous and laboratory tests for parasitic infestation showed none. The patient was treated with neoarsphenamine and showed a dramatic response, being clinically cured within three weeks.

Randolph and Rawling,[24] reporting on the cellular reactions of the blood of persons sensitive to sulfonamide drugs, describe asthmatic attacks occurring in 3 persons who were known to be clinically drug sensitive. Trial injection of a specific sulfonamide drug resulted in an initial diminution of the total number of leukocytes and of the percentage of eosinophils, followed by an increase of the number of leukocytes due in part to the presence of young myeloid cells. The authors feel that the clinical and hematologic response in these patients supports the thesis that an allergic mechanism is responsible for the reaction.

CENTRAL NERVOUS SYSTEM

In discussing the autonomic nervous system in relation to allergy, Kuntz [25] states that the common manifestations of allergy, such as hay fever, asthma, eczema and diverse anaphylactic reactions, are probably

---

22. Mansmann, J. A.: The Diagnostic Value of the Eosinophil in Allergic States, Ann. Allergy **3**:191-199, 1945.

23. Hirst, W. R., and McCann, W. J.: Tropical Eosinophilia: Report of a Case, U. S. Nav. M. Bull. **44**:1277-1281, 1945.

24. Randolph, T. G., and Rawling, F. F. A.: Blood Studies in Allergy: III. Cellular Reactions in Sulfonamide Sensitivity, J. Allergy **16**:17-29, 1945.

25. Kuntz, A.: The Autonomic Nervous System in Relation to Allergy, Ann. Allergy **3**:91-100, 1945.

invariably associated with abnormal functional states of the autonomic nerves, which may be induced by the reactions of the tissues sensitized to the agent in question. Not infrequently, the modified functional status of the autonomic nervous system is an etiologic factor of allergic disease. He writes further that the so-called allergic state does not exist in the presence of a normal functional state of the autonomic nerves, and he reviews the common manifestations of allergy due to emotional conflict, anxiety and mental conflict.

The role of the central autonomic center is especially emphasized by the emotional factors of allergic disease, according to Kuntz. The change of smooth muscle tonus commonly associated with allergic disease, for example, the increased tonus of the bronchial musculature observed in bronchial asthma, indicates heightened parasympathetic activity. The increased secretory activity associated with allergic catarrhal inflammation of the nasal, pharyngeal and bronchial mucosal membranes indicates exaggerated activity of the parasympathetic nervous system.

The author states that imbalance of the autonomic nervous system can best be detected by the use of pharmacologic agents. In general, those persons with exaggerated sympathetic tonus react more strongly to sympathomimetic agents than do those with normal balance. Ergotamine was used to block sympathetic nerves, and atropine, to block parasympathetic nerves. In the presence of exaggerated sympathetic tonus a larger dose of ergotamine was required to block adrenergic function than in the presence of a normally functioning autonomic system. Similarly, a greater than normal dose of atropine was required to block cholinergic activity in a person with exaggerated parasympathetic tonus.

Also, according to Kuntz, the allergen-antibody reactions are closely related to the specific immune reactions, the nervous regulation of which is mediated through the cholinergic nerves. The sympathetic nerves influence the production of nonspecific immune substances. Sensitization to a specific allergen undoubtedly involves increased cholinergic stimulation.

It is further stated by the author that parasympathetic hyperactivity is also accompanied by a shift in the acid-base balance toward acidity, and adrenergic hyperactivity, by a shift toward alkalinity. The acid-base balance plays a significant role in all diseases in which the autonomic nerves are directly involved, and appropriate therapeutic measures for restoring the acid-base balance to normal should be instituted in many cases of allergic disease.

Mogan and Baumgartner,[26] in a discussion of Ménière's disease, write that it is caused by a disturbance of the chemical or the nervous

26. Mogan, R. F., and Baumgartner, C. J.: Ménière's Disease, Arch. Otolaryng. **41**:113-116 (Feb.) 1945.

control of the auditory artery such that serum is extravasated into the scala media. Both the organ of hearing and that of equilibrium are supplied by this artery, and so both hearing and equilibrium are affected simultaneously. Ménière's disease may be due to any of four probable causes:

1. Pathologic changes may occur in the sympathetic nervous system that cause excessively strong impulses to pass along the sympathetic nerves.
2. There may be an excess of vasoconstrictor substances in the blood.
3. The local area may be hypersensitive to metabolites in the local area.
4. The local area may be hypersensitive to metabolites, allergens or hormones.

Regardless of which condition produces the disease, the mechanisms are essentially the same. An excessive stimulation of either branch of the sympathetic nerve to the internal ear causes a vasodilatation or a vasoconstriction such that an excessive amount of serum is immediately filtered into the scala media, or else a secondary reaction of vasodilatation follows a marked vasoconstriction with a similar result. The irritants are blood borne.

Atkinson [27] had advocated that the histamine skin test was of value in dividing cases of Ménière's syndrome into two groups as a guide to the type of therapy to be used. This statement was contradicted by Williams (1944), and the author now shows the discrepancies between his own method of making skin tests and that of Williams. He again states that the histamine test is of value as a guide to therapy.

In an article presenting the essential facts about migraine, Alvarez [28] states that the physician cannot hope to cure migraine by surgical removal of any part of the gastrointestinal tract, because migraine is an entity that is a peculiarity of the nervous system, the cause of which is to be found in the patient's heredity. The migrainous patient is frequently plagued by an added inheritance of constitutional inadequacy, psychopathy, hypertension, allergy, epilepsy, hyperthyroidism or poor pelvic organs. Such an extra handicap is likely to cause the attacks to come more frequently and be more severe.

Hartman [29] used dihydroergotamine in 20 classic cases of migraine and concluded that it was as effective as ergotamine tartrate for the relief of typical attacks and that it had the following advantages:

---

27. Atkinson, M.: Ménière's Syndrome: The Validity of the Intradermal Histamine Test, Ann. Otol., Rhin. & Laryng. **54**:801-811, 1945.

28. Alvarez, W. C.: Essential Facts about Migraine, Gastroenterology **4**:436-437, 1945.

29. Hartman, M. M.: Parenteral Use of Dihydroergotamine in Migraine, Ann. Allergy **3**:163-171, 1945.

1. It does not stimulate uterine contraction.
2. The incidence of nausea is greatly lessened.
3. There are no demonstrable effects on the muscles of the extremities after intramuscular injection.
4. There is no change in blood pressure or cardiac rate on intramuscular injection.

In a critique of psychosomatic studies, Campbell [30] states that the term "psychosomatic medicine" is an unfortunate addition to the medical curriculum, because there is really no such entity. All illnesses that may be the result of emotional conflicts are real to the sufferer. The psychiatrist has nothing more to offer the allergic patient than the allergist has to offer. The psychologic aspects of allergy may be dealt with by the allergist in much the same way as such problems have been dealt with by the family physician for ages. The "psychic" component of the disturbances of the autonomic nervous system is still very much in the realm of the unknown, according to the author.

ALLERGY IN CHILDHOOD

Pratt,[31] in a discussion of the American approach to allergy in childhood, states that in large pediatric clinics of America—for instance, the Children's Hospital in Boston—an extensive history is taken primarily from the point of view of determining specific immunologic offenders. Approximately 60 scratch tests, including the common pollens, molds, dusts, animal epitheliums and foods, are made. British pediatricians and allergists, according to the author, attempt desensitization with mixtures and do not make the attempt at specificity that is made in America.

The immuniologic approach, Pratt states, has given the best results, but it is not the ultimate solution to the atopic disease. The most rational approach is through the parasympathetic nervous system, the secretion of acetylcholine and the physiology of histamine or some histamine-like substance. For this reason, much can be said for the methods other than immunologic which are more prevalent in Britain than in America.

Campbell [32] writes that the reports of questionnaires sent to 600 obstetricians, allergists and pediatricians suggest that any one of many signs may indicate that the infant is potentially allergic. These include anaphylactic shock from human milk, retroauricular intertrigo, infantile

30. Campbell, C. H.: A Brief Critique of Psychosomatics, Ann. Allergy **3**:163-171, 1945.

31. Pratt, H. N.: American Approach to Allergy in Childhood, Proc. Roy Soc. Med. **37**:309-310, 1945.

32. Campbell, G. A.: Allergic Manifestations of the Newborn Period, Canad. M. A. J. **52**:280-283, 1945.

eczema, vomiting, wheezing, seborrhea, intestinal bleeding after a feeding of cow's milk, geographic tongue, excessive sneezing and edema of hands and feet. The author analyzed the histories of 200 cases of allergy of late infancy and childhood and states that in 25 per cent of them allergic symptoms were present during the newborn period which might easily have been recognized.

Clein,[33] who studied 100 allergic children from the time they were born until they were 10 years of age, discusses two groups of allergic symptoms: (1) the early infancy group, consisting mainly of a rash, vomiting and gastrointestinal symptoms, and (2) the major allergic disease, namely, perennial allergic rhinitis, pollen hay fever, asthma, eczema, hives and gastrointestinal symptoms.

Eighty-two per cent of the allergic babies had their first allergic symptoms before the age of 4 months. Rash or eczema was present in 53 and was usually due to some food, especially to orange juice. Vomiting or pylorospasm occurred in 36 and was usually due to oranges or milk. Gastrointestinal allergy, consisting of severe colic, excessive gas, recurrent diarrhea or constipation, was present in 23.

In only 2 of the 100 infants did major allergic symptoms fail to develop over the ten year period; in 59 perennial allergic rhinitis developed; in 38 hay fever (pollinosis), in 26 asthma, in 33 eczema, in 20 gastrointestinal allergy, in 2 hives and in 2 migraine.

Apparently, the first allergic symptom that developed had no influence on the type of major allergy which developed later, because approximately the same number of children later had perennial allergic rhinitis, hay fever or asthma whether the first symptom was a rash or vomiting. Eighty-five per cent of the major allergies developed within the first six years. Early diagnosis, prophylaxis and treatment are of great importance in preventing the development of a major allergy after 6 years of age.

Treatment of these children, Clein says, consisted in elimination, substitution and avoidance of irritating factors, such as foods, inhalants and contact substances. Twenty-eight were desensitized with specially prepared individual antigens consisting of inhalants such as pollens, epidermal elements, dust and molds. Excellent results were obtained in 73 children, who became symptom free. Good results were obtained in 16, and only fair or not much improvement was observed in 11.

Ratner,[34] in a discussion of abdominal pain due to allergy in children, states that foods may produce abdominal pain in children, with smooth

33. Clein, N. W.: The Growth and Development of Allergy: A Ten Year Study of One Hundred Allergic Children from Birth to Ten Years of Age, Ann. Allergy **3**:1-11, 1945.

34. Ratner, B.: Abdominal Pain in Children Due to Allergy, J.A.M.A. **127**: 696-699 (March 24) 1945.

muscle spasm, wheal formation and edema as the significant factors in the genesis of the allergic reaction of the gastrointestinal tract. Any portion of the tract may be involved in the reaction.

The author states that the pain produced by the allergic reaction usually occurs promptly after the ingestion of the food but that it may be delayed for at least one hour and is of variable duration. It usually occurs in the region of the umbilicus and is cramplike. Nausea, vomiting and diarrhea may also be present.

It is further stated by the author that skin tests made with the offending foods are frequently negative, especially when there is no accompanying cutaneous or bronchial involvement, and that epinephrine or atropine may relax an allergic spasm and clarify the diagnosis.

Epstein,[35] in a report of 100 infants consecutively hospitalized for eczema, states that these 100 infants with various types of infantile eczema were successfully hospitalized without a fatality. Complications occurring in the group were seen almost exclusively among children with the atopic type of dermatitis. These complications were mostly infections of the respiratory or the gastrointestinal tract. Cutaneous infections were seen among both the infants with the atopic and those with the nonatopic type of dermatitis. The complicating infections were controlled by use of the sulfonamide compounds.

The author states that sudden deaths of eczematous infants are believed to be due to injudicous use of the coal tar ointments, which may produce phenol poisoning. Because of the danger of such poisoning, he advises that tar ointments should never be applied over large areas of the body surface, especially when the skin is in an eroded state.

FOOD ALLERGY

Tuft, Blumstein and Wenger,[36] from a study of food extracts, report that these extracts, especially those of fruits and vegetables, prepared under standard conditions, varied considerably in nitrogen content. This variation was apparently due to inconstancy in the raw material. Furthermore, the authors state that the allergenic activity of the extracts seemed to bear no constant relation to their nitrogen content.

The authors devised a method of biologic assay for standardizing food extracts. The method is based on principles similar to those used in such serologic procedures as the typhoid agglutination test, in which the titrations obtained on serums of normal persons are considered as being within the normal limits, and any higher titer is considered as

35. Epstein, S.: Hospital Morbidity and Mortality in Infantile Eczema: A Report of One Hundred Consecutive Hospitalized Cases of Infantile Eczema Without Deaths, J. Pediat. **26**:541-555, 1945.

36. Tuft, L.; Blumstein, G. I., and Wenger, L. J.: Studies in Food Allergy: IV. Variations in the Allergenic Activity of Food Extracts, J. Allergy **16**:92-100, 1945.

positive. Food extracts in varying dilutions are tested on nonallergic persons and on patients known to be sensitive to these allergens. The final testing concentration is that which fails to produce nonspecific reactions in the controls and yet evokes specific reactions in the hypersensitive patients.

Ratner's [34] report of abdominal pain due to food allergy in children is mentioned on pages 702 and 703, and the roles of milk and orange juice in gastrointestinal allergy according to Clein's [33] views are mentioned on page 702.

Randolph states that uncontrolled food allergy results in symptoms of weakness and fatigue which remain unrelieved by an amount of rest that formerly was adequate or excessive. This type of allergy usually occurs in association with migraine and gastrointestinal or nasal allergy, and the dietary offenders are rarely detected by the patient himself. The physical examination, the roentgen plates and the routine laboratory procedures usually reveal nothing to explain the disease in these cases, according to the author, and skin tests performed with food allergens cannot be used diagnostically.

The fatigue syndrome must be differentiated from fatigue of organic and of functional origin. The patients, the author states, must be studied by means of trial diets or by diets based on the results of feeding tests made with several of the major allergenic foods.

The author gives several illustrative clinical cases.

TREATMENT

A method of administering antigenic substances to the hypersensitive patient is described by Deissler.[37] He recommends that 1 cc. of epinephrine in oil be administered twenty minutes prior to the final dose of antigen. This is thought to be especially valuable when insulin, or pituitary or parathyroid extract, or estrogens or androgens are given to patients who are moderately or mildly hypersensitive to them but who must be given injections of one or another of these substances for various reasons, such as:

1. Acidosis or coma makes desensitization of a diabetic patient who is hypersensitive to insulin an impossibility at the time.
2. A severe stage of pernicious anemia necessitates injection of liver extract in a person hypersensitive to this extract.
3. Glandular substances, such as pituitary or parathyroid extracts, or androgens or estrogens, are inefficient or ineffective by oral administration.

---

37. Deissler, K. J.: Routine Technique of Administration of Antigenic Substances to Hypersensitive Patients: Suggestion for Modification, Ann. Allergy **3**: 71, 1945.

Urbach, Jaggard and Crisman [38] state that oral or parenteral administration of food propeptones (i. e., protein foods digested sufficiently to be free of native protein but still retaining their type specificity) followed by administration of the given food allergen brings about a more or less lasting state of deallergization. The duration of this state depends on the quantity, the timing and the route by which the propeptones are administered.

Experimental guinea pigs were given intravenous injections of mounting doses of propeptones and then intravenous injections of multiple shock doses. The experimental animals were killed one hour after the last injection, and the Schultz-Dale test method revealed no antibodies in the uteri, but there was an abundance of antibodies in the lungs. However, if the animals were killed six hours after the injections, no antibodies could be demonstrated either in the lungs or in the uteri. This neutralization of the antibodies was only temporary, however, since the Schultz-Dale test became positive again in twelve hours.

The authors' explanation of the immunologic action of the food propeptones is that microshocks are engendered by the propeptones which lead to specific antianaphylaxis. The propeptones bring about, first, partial and tansient, then complete but transient, and, lastly, complete and lasting neutralization of the tissue antibodies.

The authors feel that these experiments suggest that specific propeptone therapy would be of value in combating food allergy in man.

The same authors [39] experimented with food propeptones in oral deallergization of orally allergized animals. Guinea pigs were allergized orally with food proteins, and by oral administration of these same proteins allergic manifestations were elicited which could be inhibited by oral administration of food propeptones.

The authors state that guinea pigs can be allergized to orally administered native food protein if the gastrointestinal tract is first irritated by means of alcohol or glycyrrhiza. This irritation increases the resorptive capacity of the intestinal mucosa. Three weeks later food protein of the same type given orally can evoke clinical anaphylactic manifestations, including maximal emphysema in the lung perfusion test.

It is further stated by the authors that in oral treatment food propeptones are effective only when followed after a certain interval of time by the corresponding food allergen by mouth. When this procedure is continued for several consecutive days, the propeptones will

38. Urbach, E.; Jaggard, G., and Crisman, D. W.: Experimental Approach to Oral Treatment of Food Allergy, Ann. Allergy **3**:172-186, 1945.

39. Urbach, E.; Jaggard, G., and Crisman, D. W.: Experimental Approach to Oral Treatment of Food Allergy: III. Oral De-Allergization with Food Propeptones of Orally Allergized Animals, Ann. Allergy **3**:287-296, 1945.

fully inhibit the clinical and characteristic pathologic allergic manifestations. Negative reactions to lung perfusion tests indicate that propeptones also neutralize the antibodies in the primary shock organ, the lung.

According to the authors, it is highly probable that in everyday life oral deallergization of human beings is brought about mainly through physiologically formed degradation products of food proteins digested in the gastrointestinal tract, such as the proteoses and the peptones.

Landau and Gay [40] used propeptones in the treatment of ragweed hay fever. They selected a small group of patients for treatment with pollen propeptones, prepared in capsules, which were liberally supplied by the manufacturer. In these patients the total duration of hay fever varied from six to twenty-one years, the symptoms being strictly seasonal except for 3 patients who also had spring hay fever.

In 7 cases the treatment was started six weeks before the onset of the ragweed season; in 4, at five weeks and four weeks before the onset. At the start the patient took every day one capsule containing 60,000 units of giant ragweed and dwarf ragweed, combined in equal parts. The dosage was increased to 6 capsules a day, and this dosage was maintained until the end of the season.

The authors state that the treatment was a complete failure in 5 of the 11 cases, while in 6 relief was fair at best. In not a single case was there a good or an excellent result. Side effects were noticed in 4 cases, ranging from slight occasional abdominal pain and itching of the skin to nausea, diarrhea and severe abdominal cramps.

The antigen titers following treatment were high in the passive transfer tests, exceeding considerably the titers noted for most of the patients who had repeated tests before the treatment.

Conway,[41] in a review of the increasing prevalence of hay fever and the latest methods of treatment, states that he used a method of oral therapy in 3,600 cases, in 95 per cent of which there was complete relief of symptoms. The patient was first tested to determine to what pollen or other allergenic substances he was sensitive. The patient was then given a solution of the allergen indicated, of a known concentration, which he took, beginning with 1 drop a day, by mouth, and increasing the dose to 20 drops a day. If symptoms were not relieved by this dose, it was further increased to meet the needs of the patient and the seasonal requirements. If 40 drops of a 2 per cent solution did not relieve the symptoms, other factors, such as certain foods or other inhalants, were investigated as being partially responsible for the symptoms. If aggravation of the symptoms occurred from

40. Landau, S. W., and Gay, L. N.: Propeptones in the Treatment of Ragweed Hay Fever, J. Allergy **16**:159-161, 1945.

41. Conway, L.: Hay Fever: Increasing Prevalence and Latest Method of Treatment, M. Times, New York **73**:110-111 and 121, 1945.

overdosage, the oral allergic therapy was discontinued completely, and then the treatment was started again with 1 drop per day and the dose gradually increased until a maintenance dose was found.

Loveless,[42] in a discussion of the conjunctival test as a guide to clinical immunity to hay fever, states that it has been shown that the clinical improvement which is noted in pollen-sensitive patients after a series of injections may be related, at least in part, to thermostabile antibodies developing in the blood and the tissues. These antibodies may raise the local tolerance by binding the pollen antigen. If the previous statements are true, according to the author, the state of susceptibility of the eye determined prior to the onset of the hay fever season should give a clue as to whether the patient will react during the time of pollination, and thus it would be a reliable guide by which the allergist could assess in advance of the season of pollination the adequacy of his specific therapy.

The author observed 95 patients with hay fever during 1943 and 1944, 44 being observed for two years. A comparison was made between the threshold of conjunctival reaction observed at the onset of the season and the degree of clinical refractoriness subsequently noted while ragweed was in bloom.

The extracts with which the conjunctival test was made were standardized on the basis of the amount of nitrogen precipitated by phosphotungstic acid. The test was initiated with 1 drop of a solution containing 1 P. N. unit per cubic centimeter Then solutions of increasing strength were used until the reaction point was reached. The test varied unimportantly with the operator, with two extracts of the same pollen and with an interval of a few weeks.

As stated, 95 patients were observed for one or two ragweed seasons, and 95 per cent of those with thresholds of 350 to 500 units reported good or excellent clinical results, while only 49 per cent of those with thresholds of 35 units or less showed satisfactory clinical control of their hay fever. According to the author, this seems to indicate that newly acquired patients should be given "booster" courses adequate to raise the threshold to at least 300 units if possible.

The author thinks the conjunctival threshold test gives promise of serving as a guide to the amount of specific treatment required by the hay fever patient.

Cohen and Friedman,[43] in treating ragweed pollinosis with antigen-antibody mixtures, tried to determine whether a mixture of antigen and thermostabile antibody could be more successfully employed in the treat-

42. Loveless, M. H.: The Conjunctival Test as a Guide to Clinical Immunity in Hay Fever, Ann. Allergy **3**:333-340, 1945.

43. Cohen, M. B., and Friedman, H. J.: Treatment of Ragweed Pollinosis with Antigen-Antibody Mixtures, J. Allergy **16**:121-124, 1945.

ment of hay fever than other methods at their disposal at the present time. Mixtures of thermostabile antibody and pollen extract which were approximately neutral or contained not more than 100 units of free antigen per cubic centimeter were prepared. These mixtures stimulated the production of thermostabile antibodies in both normal and pollen-sensitive persons. They were administered to sensitive persons in individual doses containing as much as 12,000 P T A units of neutralized antigen without systemic reactions. Three pollen-sensitive patients treated with these mixtures obtained good clinical results with only three or four injections of the material.

Heise [44] states that in allergy desensitization is not a neutralizing of antibodies by the injection of small quantities of antigen, as it is believed to be by many. According to him, the purpose of treatment of allergic disease is to increase the immunity of the site of injection, that is, the skin and the reticuloendothelial system, without stimulating those tissues already immune. In the treated tissues local immunity develops by the production of fixed cellular antibodies, which spares the original shock organ with the unfavorable antigen-antibody reactions. The process thus is one of simple immunization which utilizes the expedient of shifting the shock from the original organ to one that is better suited to immunologic conflict, in the ultimate hope of humoral immunity with insulation of all shock organs.

Struble,[45] discussing penicillin therapy as applied in the practice of otolaryngology, states that it is of definite value and is particularly applicable to the treatment of many diseases of ear, nose and throat, because the great majority of the pathogenic organisms encountered at these sites are of the penicillin-sensitive type. Penicillin offers the great advantage of having apparently no toxicity for the hemopoietic system and thus can be used to treat patients with acute fulminating infections even when leukopenia is present.

The author discusses the use of penicillin with regard to many diseases of ear, nose and throat.

Hauser and Work [46] treated 3 patients for severe allergic rhinitis and superimposed infection by means of penicillin, which was given intramuscularly every three hours in doses of 15,000 units for a total of 465,000 to 2,000,000 units. There was complete disappearance of pus, as well as recession of polypoid tissue, but in 2 patients there was still a persistent mucoid discharge at the completion of treatment. The authors did not feel that the use of penicillin effected a permanent cure, since the underlying pathogenic state, allergy, was still present.

---

44. Heise, H. A.: Desensitization in Allergy, Am. J. Clin. Path. **15**:77-81, 1945.

45. Struble, G. C.: Penicillin Therapy in the Practice of Otolaryngology, Arch. Otolaryng. **42**:327-338 (Nov.-Dec.) 1945.

46. Hauser, I. J., and Work, W. P.: Treatment of Sinusitis with Penicillin, Arch. Otolaryng. **41**:161-169 (March) 1945.

Leopold and Cooke,[47] who used penicillin in the treatment of intractable bronchial asthma, state that this antibiotic appeared to be of value in 2 cases in which the asthma was intrinsic in nature. They are studying its effects in 25 additional cases. In some of these cases results have been favorable, while in others there has not been a satisfactory response.

Hamptom, Wine, Allen, Thompson and Starr [48] also used penicillin in treating intrinsic bronchial asthma. They report that allergic management had been unsuccessful in 9 cases of intrinsic bronchial asthma. In 8 of the 9 cases there were positive reactions to inhalants, but negative reactions to all food tests. Five of the patients were given penicillin intramuscularly, each receiving a total of 500,000 units. One patient received 800,000 and one 1,300,000 units.

There was, according to the authors, clinical improvement in only 4 patients; it was slight, and the authors did not feel that it was due to the pencillin therapy.

Schonwald and Deppe,[49] in a report of antibiotic treatment of intrinsic allergies, state that such allergies are bacterial allergies and that antibiotic therapy may influence the allergenic effect of bacterial toxins. They give the results obtained with "crude" and commercial penicillin in 86 cases of allergy, 21 of intrinsic type and 65 of mixed type. They followed the method of Fisher, using a medium containing a completely hydrolyzed protein, which is supposedly not allergenic. The purified and sterile broth containing the antibiotic substance does not cause a rise in temperature when given hypodermically, but it does produce some local pain and erythema in about 10 per cent of the cases. Of the 86 patients treated, 16 showed no improvement, while 35 showed moderate and 34 marked improvement.

Commercial penicillin was used in 13 cases, 2,500 units being given intramuscularly two or three times a week. Its effects were just as satisfactory as those obtained with the purified sterilized broth containing the antibiotic substance.

Proetz [50] studied the action of cilia which were in contact with solutions of penicillin of various strengths. He suspended strips of the ciliated type of respiratory epithelium, taken from a rabbit, in a bath containing the solutions of penicillin at 30 C., for various periods. His

47. Leopold, S. S., and Cooke, R. A.: Penicillin in the Treatment of Intractable Bronchial Asthma: A Preliminary Report, Am. J. M. Sc. **209**:784-787, 1945.

48. Hamptom, S. F.; Wine, M. B.; Allen, W.; Thompson, C. S., and Starr, M. P.: The Clinical Use of Penicillin in the Treatment of Intrinsic Bronchial Asthma, J.A.M.A. **127**:1108-1109 (April 28) 1945.

49. Schonwald, P., and Deppe, E. F.: Penicillin Antibiotic in the Treatment of Intrinsic Allergies, Northwest Med. **44**:10-14, 1945.

50. Proetz, A. W.: Cilia and Penicillin: A Laboratory Note, Ann. Otol., Rhin. & Laryng. **54**:94-95, 1945.

observations indicate that the strength of solution recommended for intranasal and intrasinal application, 250 units per cubic centimeter of isotonic solution of sodium chloride, has no appreciable adverse effect on respiratory ciliated epithelium. Stronger concentrations tended to impair ciliary action.

Derbes and Wilson [51] discuss 2 cases in which asthma occurring with bronchial infection was treated with 500,000 units of penicillin, injected intramuscularly in divided doses. In both cases the condition was definitely improved, although in 1 case irreversible pulmonary changes were unaffected. The authors believe that penicillin will be a helpful adjunct in the treatment of asthma due to bronchial infection.

Rackemann [52] states that the treatment of asthma is based on two rules:

1. Remove all allergens indicated as possible offenders by the case history or by positive skin tests.
2. Do everything possible to improve the health of the patient, especially everything to protect the patient against new infection, and so raise the threshold over which allergy may enter.

The general health is improved by regulating the time and the quality of the meals, the supply of fresh air and the daily activity, instituting adequate periods of rest, as well as of outdoor exercise, and administering extra supplies of the vitamins and vaccines in most of the cases.

Reporting on the electrolyte excretion with various forms of therapy for bronchial asthma, Stoesser and Booth [53] state that children with intractable asthma have received notable clinical benefit from artificial fever therapy, ingestion of potassium chloride, and diets low in sodium chloride. Increased intake of sodium chloride promptly caused a return of the asthma.

The authors investigated 6 cases of chronic asthma in children and found that the ingestion of potassium chloride led to diuresis and loss of sodium. This was usually associated with an apparent reduction of the severity of the asthmatic symptoms. The disease was apparently aggravated by the retention of sodium which occurred with the ingestion of sodium chloride or with the administration of adrenal cortex extract.

Price,[54] reporting a severe allergic reaction that followed intramuscular injection of penicillin, states that the patient, whose right leg had been traumatized, was given 20,000 units of penicillin every three

51. Derbes, V. J., and Wilson, J. L.: Asthma with Bronchial Infection Treated with Penicillin, Ann. Allergy **3**:204-206, 1945.

52. Rackemann, F. M.: Depletion in Asthma, J. Allergy **16**:136-139, 1945.

53. Stoesser, A. V., and Booth, M.: The Electrolyte Excretion with Various Forms of Therapy in Bronchial Asthma, J. Allergy **16**:232-236, 1945.

54. Price, I. C.: Severe Allergic Reaction to Intramuscular Penicillin: Case Report, Canad. M. A. J. **53**:485-486, 1945.

hours for five days; then a punctate purpuric eruption appeared on the flexor surfaces of the arms and on the surfaces of the abdomen, the chest and the back. This was followed by a severe generalized giant urticaria. Treated with epinephrine, the urticaria disappeared in four days.

Skin tests suggest that patients presenting urticarial eruptions due to penicillin require a penicillin-allergen mixture, presumably a penicillin-protein mixture, rather than penicillin alone. Presumably, the patient's own serum provides the necessary protein.

Morris and Downing [55] state that reactions resulting from the use of penicillin may be due to the drug itself or to toxic impurities contained in an individual batch of the material. They observed bullous dermatitis in a 56 year old man who had received 1,000,000 units of penicillin postoperatively for an infection. Four days after the first injection puritus of the left hand and arm developed, followed in twenty-four hours by edema of the parts and the left side of the trunk. A tense, pitting edema, accompanied by erythema and bullae, involved the entire left hand and forearm. The dermatitis persisted for four to five days.

Zeller [56] discusses a severe urticaria occurring in a 35 year old woman on administration of penicillin. With the outbreak of the urticaria, the injections of penicillin were discontinued for ten days, and then were given again. The second series of injections was started with very small daily doses. Later doses gradually increased to reach the therapeutic dose of 20,000 units on the ninth day. No reaction was noted during the second series. The component of the penicillin responsible for the urticaria could not be determined. It was concluded that not only the urticaria caused by the penicillin but also the positive skin test and the passive transfer may be temporary.

The author thinks that the results of the treatment are warrant for trying graduated doses of penicillin in the desensitization of patients who present severe penicillin urticaria.

Vaisberg [57] states that 2 patients who had severe contact dermatitis were treated with tyrothricin wet packs and penicillin. The tyrothricin packs were first used for about two days; then penicillin was given either intramuscularly or orally concomitantly with the tyrothricin. The itching stopped immediately, and the involved areas of skin healed within three weeks.

Gay [58] reports that because beeswax is prevalently used for intramuscular injection of penicillin he performed scratch tests and intra-

55. Morris, G. E., and Downing, J. G.: Bullous Dermatitis (Dermatitis Medicamentosa) from Penicillin, J.A.M.A. **127**:711 (March 24) 1945.

56. Zeller, M.: Penicillin Urticaria, Ann. Allergy **3**:360, 1945.

57. Vaisberg, M.: Combined Tyrothricin-Penicillin Therapy in Contact Dermatitis, Ann. Allergy **3**:451, 1945.

58. Gay, L. N.: The Non-Antigenic Property of Beeswax, J. Allergy **16**:192-195, 1945.

cutaneous tests with a 4 per cent beeswax–peanut oil mixture on patients with known pollen sensitivity, that is, asthma or hay fever. No reaction occurred. Microscopically, no pollen could be identified in crude beeswax.

The author thinks the results of the tests indicate that beeswax combined with peanut oil should, because of its nonantigenic character, be an ideal absorption-delaying medium in which to administer penicillin by the subcutaneous or the intramuscular route.

Zeller,[59] having observed an unusual effect of aminophylline on the intestinal tract, gives a report of the case. The patient, a woman 42 years of age, had suffered from bronchial asthma and hay fever for fifteen years, from intestinal distention, attacks of nausea and vomiting for eighteen years and from frequent headaches. Surgically, an appendectomy, a cholecystectomy and two laparotomies had failed to give relief. Her skin reacted to grass and ragweed pollens and dust. Ingestion tests disclosed sensitivity to a number of foods, manifested by abdominal distention and pain.

An intravenous injection of 7½ grains (0.49 Gm.) of aminophylline (the equivalent of a 2 cc. ampule of aminophylline injection U.S.P.) not only relieved the asthma but at the same time relieved the abdominal distention. Oral doses as high as 25 grains (1.62 Gm.) given every day produced no relief of the abdominal symptoms.

The author suggested that aminophylline may be useful in the diagnosis and treatment of the allergic bowel.

Barach[60] states that in the therapy of intractable bronchial asthma the rectal instillation of aminophylline injection U.S.P. is easily accomplished by a nurse or by the patient himself. A no. 12 French catheter, a rubber tube connection and a 20 cc. glass syringe yield satisfactory results. While the relief does not occur as rapidly or as regularly as it does with the intravenous administration, the side effects of the drug are less pronounced when this route is used.

Giordano[61] states that he has obtained good results with minimal doses of acetylcholine in various allergic conditions, such as eczema, neurodermatitis, urticaria and edema, and bronchial asthma when he used it in association with histamine or specific desensitization. He employed a 1:1,000 solution of acetylcholine, administering 0.025 to 0.05 cc. by subcutaneous injection daily or every other day, according to the reaction noted. Improvement was noted following the first injec-

59. Zeller, M.: An Unusual Effect of Aminophylline on the Intestinal Tract: Case Report, Ann. Allergy **3**:369-370, 1945.

60. Barach, A. L.: Rectal Instillation of Aminophylline in Intractable Asthma, J.A.M.A. **128**:589 (June 23) 1945.

61. Giordano, A. F.: Acetylcholine in the Treatment of Allergic Conditions, Semana méd. **52**:138-140, 1945.

tion, but the dose must be increased cautiously to avoid parasympathetic nerve action.

Shea [62] has listed the clinical entities in the treatment of which either histamine or nicotinic acid is used.

Lockey [63] describes the use of a glycerinized epinephrine hydrochloride formula plus a mixture of carbon dioxide 10 per cent and oxygen (90 per cent), administered by the continuous inhalation method, for the relief of asthmatic attacks. The epinephrine relieves severe attacks of asthma, while the carbon dioxide increases the absorbing power of the bronchial mucosa and helps liquefy the sputum, thus acting as an expectorant. Glycerin prevents dryness of the mucous membranes. After the inhalation of this epinephrine-glycerin-gas mixture, asthmatic patients are aided in coughing up and expectorating mucous plugs.

Wilkner [64] describes a method of combining the use of a 1:100 solution of epinephrine hydrochloride, helium and oxygen in one apparatus. The amount of helium and oxygen used is kept to a minimum by rebreathing, a circle filter being used. The effect of epinephrine is to produce speedy bronchial relaxation, but the usual cautions and contraindications must be observed in the use of a 1:100 solution of epinephrine hydrochloride.

Ratner's [34] suggestion that epinephrine, ephedrine or atropine be used to relax an allergic spasm and clarify a diagnosis of allergic abdominal pain occurring in a child has already been mentioned (pages 702 and 703).

Dees [65] states that although asthmatic subjects have significantly higher serum potassium levels than normal persons, neither in normal nor in asthmatic persons are the serum potassium levels altered after rapid subcutaneous injection of 0.75 cc. of a 1:1,000 solution of epinephrine hydrochloride. His work respecting this point was done because of conflicting reports in the literature.

Hartman [66] compared the effects of ethylnorsuprarenin, also known as "butanefrine" (racemic 1-[3,4-dihydroxyphenyl]-2-amino-1-butanol hydrochloride), and epinephrine on asthmatic persons, dividing the cases of asthma into two groups: those of reflex and extrinsic origin uncom-

62. Shea, J. J.: The Therapy of Histamine and Nicotinic Acid, Laryngoscope **55**:325-336, 1945.

63. Lockey, S. D.: Inhalation of Ten Per Cent Carbon Dioxide and Ninety Per Cent Oxygen Plus 1:100 Glycerinized Epinephrine Hydrochloride for the Relief of Asthmatic Attacks, Ann. Allergy **3**:362 (Sept.-Oct.) 1945.

64. Wilkner, I.: Combined Helium and Epinephrine Therapy, Ann. Allergy **3**:187-190, 1945.

65. Dees, S.: Serum Potassium Response to Epinephrine in Normal and Asthmatic Subjects, Ann. Allergy **3**:64-70, 1945.

66. Hartman, M. M.: Parenteral Use of Butanefrine in Asthma: A Comparison with Epinephrine, Ann. Allergy **3**:366-368, 1945.

plicated by infection, and those in which asthma was accompanied by definite bronchial infection. The latter group included asthma of both intrinsic and extrinsic origin.

In the first group (23 cases) "butanefrine hydrochloride" 1 : 500 and epinephrine hydrochloride 1 : 1,000, both given hypodermically, were equally effective in relieving the asthmatic symptoms.

When bronchial infection was present, in 17 cases the effectiveness of "butanefrine" was considerably less than that of epinephrine, because "butanefrine" lacks the vasoconstrictor property present in epinephrine. However, nausea, angina and pressor effects were entirely lacking with the use of "butanefrine," and tremor and nervousness occurred much less frequently and with less severity than with the use of epinephrine.

The author also states that "butanefrine" is safe to administer in case cardiac asthma is mistaken for allergic asthma.

Archibald[67] reports that a group of 45 allergic children suffering from hay fever, asthma or eczema was studied with respect to the effect of ethylene disulfonate. Eighteen of the children received the compound in question, 18 as controls received distilled water and 9 received first ethylene disulfonate and later sterile distilled water after the symptoms had recurred. The results, according to the author, indicated that ethylene disulfonate was no more effective than other nonspecific therapeutic agents, such as milk, peptones or distilled water.

Friedlaender and Feinberg,[68] in the management of a series of patients suffering from hay fever, both adults and children, gave 500 mg. of ascorbic acid in addition to their regular diets. The blood levels of ascorbic acid (vitamin C) of hay fever patients are normal, and large doses of this vitamin produce the usual saturation levels without altering the course of hay fever or asthma, according to the authors.

On the other hand, Ruskin,[69] discussing high doses of ascorbic acid in connection with allergies, states that a rabbit's lungs were filled with warm gelatin, placed in ice cold Ringer-Locke solution, the composition of which they give in detail, and then kept in the freezing compartment of a refrigerator for one to one and a half hours. From each lobe thin sections of tissue, 0.5 to 1 mm. thick, were cut, transverse to the bronchioles. The section of tissue to be used was pinned out on a ring of cork in a Petri dish, covered with Ringer-Locke solution and warmed to 37 C. Camera lucida drawings of the bronchiolar lumen were made.

---

67. Archibald, H. C.: Ethylene Disulphonate and Sterile Distilled Water Controls in the Treatment of Children's Allergies, Arch. Pediat. **62**:219-222, 1945.

68. Friedlaender, S., and Feinberg, S. M.: Vitamin C in Hay Fever: Therapy and Blood Levels, J. Allergy **16**:140-145, 1945.

69. Ruskin, S. L.: High Dosage Vitamin C in Allergy, Am. J. Digest. Dis. **12**:281-313, 1945.

The primary purpose of the experiment was to produce contraction of the bronchioles by adding histamine hydrochloride and then to test a given substance for histamine antagonism by adding it to the preparation. The author reports the results substantially as follows:

1. Sodium ascorbate and ascorbic acid did not influence the speed of recovery from histamine contraction but did produce antagonism to the second dose of histamine hydrochloride.

2. Ephedrine sulfate caused a slight inhibition of recovery from the effect of histamine hydrochloride, with little or no antagonism to the second dose of histamine.

3. With ephedrine ascorbate there was quick recovery from the histamine contraction as well as fair antagonism to the second dose of histamine.

4. Calcium gluconate increased the contraction of the bronchioles to histamine, while calcium ascorbate was more effecive than ascorbic acid or sodium ascorbate in antagonizing histamine.

The author concludes that ascorbic acid given in doses of 250 to 750 mg. daily was valuable in the treatment of patients with nasal allergy and, in general, would be of advantage with or without desensitization. The author thinks allergic disturbances are related to nutritional deficiencies, primarily that of ascorbic acid.

Black,[70] reporting on treatment of urticaria with synthetic vitamin K, states that 305 cases of chronic urticaria were seen from September 1941 to September 1944. In 14 per cent of these the condition could be designated as angioneurotic edema, in 68 per cent as urticaria and in 18 per cent there were lesions of both types.

In approximately 50 per cent of the cases the urticaria responded to the usual methods of treatment, including skin tests, trial diets, a search for and elimination of infections and avoidance of drugs. The remaining 50 per cent were given menadione (2-methyl-1, 4-naphthoquinone) orally, 2 mg. three times a day, before meals. Prothrombin determinations were done. Approximately 66 per cent of the entire group had prolonged prothrombin times, and 78 per cent of these were relieved. Thirty-two and one-half per cent of those with normal prothrombin times were relieved. Sixty-two per cent of the group classified as "failures" with respect to the usual methods of treatment were relieved by the synthetic vitamin K. The duration of the treatment varied from one to four weeks.

Dimow [71] uses intranasal calcium therapy in cases of allergic rhinitis. Following anesthetization with a 2 per cent solution of procaine hydrochloride, 2.5 cc. of a 10 per cent solution of gluconogalactogluconate of calcium is injected into the bony margins of the two inferior turbinates,

70. Black, J. H.: Treatment of Urticaria with Synthetic Vitamin K, J. Allergy **16**:83-86, 1945.

71. Dimow, J.: Intra-Nasal Calcium Therapy in Allergic Rhinitis, Semana méd **1**:251-255, 1945.

and a small tampon of cotton saturated with a 1:10 antipyrine solution or with oxygenated water is inserted. This is withdrawn after five minutes. The patient may complain of a sensation of congestion of the head and of heat just after intravenous administration, or a slight headache may persist. The first four injections may be made biweekly; then one injection every two weeks and finally one every month up to ten injections. The spongy tissue of the turbinate is hardened without becoming sclerotic, and permeability to inspired air is increased. Hydrorrhea and sneezing are relieved, as is the itching. Some patients experience immediate relief following a single injection.

As the chronic congestion or the diffuse or localized hypertrophic rhinitis diminishes, the response of the nasal cavities increases, and the rhinolalia subsides. The circulation is improved, and the formation of polypi is prevented. The neurohormonal effect relieves nasal neuroses and subjective disturbances.

According to the author, the method is successful in 90 per cent of the cases and represents no risk to the patient. The author gives a brief report of 32 cases.

In a report of anaphylaxis due to sulfonamide drugs, Black-Schaffer [72] discusses the literature dealing with the concept of sulfonamide sensitivity and reviews previous pathologic reports. The pathologic studies made in 5 cases in which these drugs contributed to the fatal outcome are reported.

In general, two related lesions were noted, that is, arterial changes and generalized cellular exudates. The arterial lesions differed in appearance, but all reflected a linear progression from simple edema to frank necrosis. The basic lesion was a necrotizing fibrinoid arteritis of the smaller vessels. The author suggests that the observed phenomenon may be the morphologic expression of a response to "foreign cells," which, he suggests, result from "addition of some substance to blood cells (conjugated sulfonamide group?)." The nephrosis seen in cases of sulfonamide hypersensitivity is probably an expression of an "anaphylactic" renal reaction. Interstitial myocarditis was observed in all the cases.

Kent and Diefendorf,[73] reporting on sulfathiazole sensitivity, state that in 110 of 472 patients who received a primary course of sulfathiazole therapy some form of reaction to the drug developed. The highest incidence of drug fever occurred on the ninth day of therapy.

Twenty-two of 103 patients receiving a second course of sulfathiazole therapy manifested sensitivity. In this group, drug fever developed by the second day in those patients who had had drug fever during the first

72. Black-Schaffer, B.: Pathology of Anaphylaxis Due to Sulfonamide Drugs, Arch. Path. **39**:301-314 (May) 1945.

73. Kent, G. T., and Diefendorf, H. W.: A Clinical Study of Sensitivity to Sulfathiazole, Am. J. M. Sc. **209**:640-645, 1945.

course of treatment. However, 75 per cent of the patients who had drug fever during the second course had shown no reaction in the first course. According to the author, neither the absolute interval between the courses nor the dosage had any influence on the production of the reactions.

Peterkin,[74] discussing cutaneous eruptions due to the local application of sulfonamide drugs, states that a powdered sulfonamide compound was the first sulfonamide drug used in 61 of 65 severe cases of sulfonamide dermatitis observed in North Africa. It is suggested that sensitization may occur by inhalation of the powder. Dermatitis was noted in only 1 of 200 persons treated with a 5 per cent sulfathiazole ointment.

In a report on sulfonamide sensitivity and deficiency of ascorbic acid McCormick[75] states that due to the toxic effects of the chemotherapy or to the increased demand for this vitamin during infection, it is suggested that ascorbic acid deficiency may be the conditioning factor which predetermines potential sulfonamide sensitivity. A preliminary urinary test of the patient's state respecting ascorbic acid prior to the institution of chemotherapy is suggested as a prophylactic measure. If the ascorbic acid content of the body is deficient, large doses of ascorbic acid should be administered together with the sulfonamide compounds.

The author reports several cases in which sulfonamide sensitivity responded favorably to ascorbic acid therapy.

Ornston,[76] who employs microcrystals of sulfathiazole in otolaryngologic practice, states that either the powder, a 5 per cent or a 20 per cent suspension of the microcrystals in isotonic solution of sodium chloride, or a 5 per cent suspension with 1 per cent "paredrine hydrobromide" (para-hydroxy-alpha-methylphenylethylamine hydrobromide) in isotonic solution of sodium chloride is used.

The author treated 11 patients for chronic maxillary sinusitis of one to twenty years' duration which had resisted all therapy. Biweekly irrigation was followed by instillation of a 20 per cent suspension of sulfathiazole to fill the sinuses. This treatment was continued until no pus had been apparent for two weeks. The sinusitis was apparently cured in 6 of the cases, reduced in 2 and uninfluenced in 3.

In the treatment of chronic otitis media, the author states, the mucosa of the eustachian tube is first shrunk by the instillation of a 1 per cent solution of "neo-synephrine hydrochloride." This is blown through a catheter by a continuous air current at low pressure. Five minutes later, a 5 per cent suspension of microcrystals of sulfathiazole is instilled through the catheter and is forced up by the warm air current. This

74. Peterkin, G. A. G.: Skin Eruptions Due to Local Application of Sulfonamides, Brit. J. Dermat. **57**:1-9, 1945.

75. McCormick, W. J.: Sulfonamide Sensitivity and C-Avitaminosis, Canad. M. A. J. **52**:68-70, 1945.

76. Ornston, G.: Use of Microcrystals of Sulfathiazole in Otolaryngologic Practice, Arch. Otolaryng. **41**:337-342 (May) 1945.

may be repeated until the crystals are seen in the external auditory meatus. Of 27 infected ears (23 patients) which had been suppurating for three to forty-eight years, 5 became dry with five treatments, and 18 showed no improvement.

Unger,[77] discussing oxygen inflation as a new method of treatment of nasal sinusitis, states that the primary objectives of medical or surgical treatment are aeration and drainage of the sinuses. He has used a modified Bennett inhaler and oxygen. The Bennett inhaler is modified so that a flexible tube can be attached to the bottom, and to the other end of the tube is attached the outlet of oxygen control valves.

The nasal mucosa is first shrunk by being sprayed with a vasoconstrictor. The oxygen supply valve is opened to 2 liters per minute, and the patient fits the tips of the Bennett inhaler tightly into his nostrils and inhales, then exhales strongly as though blowing his nose. This raises the intranasal pressure to about 50 mm. of mercury, and thus the mucosa is shrunk by direct pressure as well as by the drawing of oxygen into the sinuses. This procedure of alternate inhalation and strong exhalation is kept up for fifteen minutes, at the end of which the mucous membrane will be found to be red and well shrunken. The membrane stays in this condition considerably longer than it would if it were sprayed only with a vasoconstrictor.

The author concludes that oxygen inflation is of no value in cases in which there has been extensive destruction of the mucous membrane. In other cases it has given better results than any other method the author has tried.

Siegel and Julianelle [78] made an epidemiologic study of acute respiratory infection as conditioned by sulfonamide therapy. Thirty children received sulfadiazine daily for a fifteen week period beginning in December 1942 and extending through March 1943. During this time there was no severe epidemic by which the prophylactic value of the drug could be judged. Both the treated children and the untreated controls suffered mild infections. Although the infections appeared to be unaffected by the drug, significant changes were observed in the bacterial flora of the nasopharynx. Toxic reactions attributable to sulfonamide therapy were negligible.

The same authors in a second article [79] discuss the alterations observed in the bacterial flora of the nasopharynx. Physically normal

77. Unger, M.: A New Method of Treatment for Nasal Sinusitis: Oxygen Inflation, Arch. Otolaryng. **41**:353-354 (May) 1945.

78. Siegel, M., and Julianelle, L. A.: The Epidemiology of Acute Respiratory Infections Conditioned by Sulfonamides: I. General Considerations, Ann. Int. Med. **22**:1-8, 1945.

79. Siegel, M., and Julianelle, L. A.: The Epidemiology of Acute Respiratory Infections Conditioned by Sulfonamides: II. Gross Alterations in the Nasopharyngeal Flora Associated with Treatment, Ann. Int. Med. **22**:10-20, 1945.

children who were treated with sulfadiazine for fifteen weeks as a prophylactic measure showed rapid disappearance of gram-negative cocci, but in the majority of them these organisms gradually returned despite a doubling of the dose of sulfadiazine. A partially inhibitory action appeared to be exerted on the hemolytic streptococci present in the throat.

Hughes and McAlister [80] report a case in which urticaria appeared in a diabetic patient about one month after the start of daily administration of protamine zinc insulin. The urticaria appeared first on the feet and ankles, later on the whole body. It was continually present, was irritating and did not yield to local treatment. The patient was sensitive on both direct and passive transfer tests to protamine zinc insulin, but not to regular insulin.

An attempt was made to carry out skeptophylactic deallergization by having the patient take one-half unit of regular insulin and of protamine zinc insulin forty-five minutes before the prescribed dose was given, in the hope that a refractory period would follow, during which the full dose might be given without bringing about the urticarial reaction. This was unsuccessful, as was the treatment in which 1, 2, 3, 4, 5, 6, 7 and 8 unit doses of protamine zinc insulin were given at fifteen minute intervals and then 15 units of regular insulin and no breakfast.

According to the authors' report, histamine azoprotein ("hapamine," Parke, Davis & Company) given by hypodermic injection, in doses of 0.1, 0.15, 0.2 cc., etc., at three day intervals produced prompt and gratifying relief of the symptoms.

Osgood [81] describes the properties and uses of papain and reports a case of atopic sensitivity to "caroid," a proprietary preparation of papain. Papain contains proteolytic enzymes and is derived from the papaya tree. It is actively antigenic and is capable of sensitizing human beings both when inhaled as a dry powder and when absorbed through glandular tissue. This sensitivity is of the atopic type, not a true drug sensitivity, and is not uncommon, because papain is used medicinally, industrially, in dentifrice, in chewing gum and in food preparations, which leads to exposures of general populations. This should be kept in mind by the allergist.

In a paper written on sensitivity to "hapamine," Epstein [82] reports 2 cases of neuritis occurring during treatment with this drug. It was

80. Hughes, R. F., and McAlister, H. R.: Urticaria Following the Use of Protamine Zinc Insulin, Ann. Allergy **3**:207-208, 1945.

81. Osgood, H.: Atopic Sensitivity to Caroid (Papain): Report of a Case with Discussion of Some of the Properties and Uses of the Drug, J. Allergy **16**: 245-249, 1945.

82. Epstein, S.: Sensitivity to Hapamine: Neuritis Occurring During Treatment with Hapamine, Internat. Corresp. Club Allergy **8**:56, 1945.

suggested by the author that patients be tested intracutaneously with dilutions of "hapamine" and also with purified horse serum protein before "hapamine" therapy is instituted. The author has never observed any reactions in cases in which the aforementioned tests were negative.

In an article covering the use and abuse of nasal vasoconstrictor medication, Kully [83] discusses the various sympathomimetic compounds used as nasal vasoconstrictors. The effects of these compounds are chiefly the result of their influence on the blood vessels of the nasal mucosa and, secondarily, of that on the secretory function. There is constriction of the subepithelial capillaries and arterioles and also of the venous sinuses of the erectile tissue. Nasal secretion is diminished in contrast to the increase of secretion when vasoconstriction results from chilling of the body. If vasoconstriction is severe and prolonged, a reaction ensues in the form of a secondary vasodilatation, involving the deeper venous sinuses. This is due to either an active vasodilator in the drug or fatigue of the constrictor mechanism.

Epinephrine and amphetamine are examples of drugs which cause severe reactions, while ephedrine and "neo-synephrine" represent those producing mild reactions. All of the adrenergic drugs, however, have some secondary congestive effect. Vasoconstrictors incorporating the sulfonamide compounds are of questionable value as antiseptics, and increase the irritation and reaction caused by the nasal medication.

In acute rhinitis a minimal use of a mild decongestant may be indicated, but here, as in other inflammatory processes, such treatment prevents the physiologic response and may prolong or alter the course of the process, inducing sinusitis or other complications. Sensitivity, indistinguishable from a true allergic reaction, may occur, due to nasal medication, in the course of vasomotor rhinitis. In such cases, discontinuance of all nasal medication may result in a clearing up of the condition.

Lehmann and Young,[84] studying the antihistaminic activity of diethylaminoethyl-dihydroantracene-carboxylate, sensitized 101 guinea pigs with egg white. Then, thirty minutes after administration of the aforementioned compound, they gave the guinea pigs shocking doses of various strengths of the antigen. All of the animals were protected by the compound against a dose of antigen which was lethal for 90 per cent of the animals of a control group. Twenty-seven per cent were protected against doses one hundred times as strong.

The authors state that the compound is presumed to exercise its protective action by producing an antihistaminic effect on smooth muscle

83. Kully, B. M.: The Use and Abuse of Nasal Vasoconstrictor Medication, J.A.M.A. **127**:307-310 (Feb. 10) 1945.

84. Lehmann, G., and Young, J. W.: The Anti-Histamine Activity of Diethylaminoethyl-Dihydroanthracene-Carboxylate and Other Substances, J. Pharmacol. & Exper. Therap. **83**:90-95, 1945.

rather than by interfering with the antigen-antibody reaction. It also diminishes the cutaneous reactions of histamine and the volume of histamine-induced gastric secretion.

Kuntz's [25] idea that acid-base balance is of importance in allergic therapy has already been mentioned (pages 698 and 699).

Wiseman and McCarthy-Brough [85] report a fatality following intracutaneous allergic testing of a woman aged 78. The case shows that even in the aged, atrophic as the skin may appear, its reactivity may be acute, and aged persons require the same meticulous care in skin testing and treatment as do patients of any age group.

DIPHENHYDRAMINE HYDROCHLORIDE ("BENADRYL HYDROCHLORIDE" N.N.R.)

"Benadryl" is the name given to a drug synthesized and developed by the research laboratories of Parke, Davis & Company. It has been found to have antihistaminic qualities to a marked degree and is nontoxic.

A variety of clinical syndromes are due to tissue release of histamine. Asthma may well be a manifestation of the action of histamine, for this amine can produce spasm of the bronchioles, edema of their mucous membrane and increased secretion in the mucous glands. Lesions of both acute and chronic urticaria, the cause of which is not known, can be reproduced by injections of histamine. The reactions of the mucous membrane of the respiratory tract present in hay fever and allergic rhinitis are likewise similar to histamine-induced reactions.

"Benadryl" has been found to be of clinical value in alleviating these conditions produced by histamine. It counteracts histamine's vasodilatory action on the skin and mucous membranes. Although it has been shown to be fifteen to thirty times as effective as aminophylline in relieving bronchial constriction, it has not proved very effective clinically in relieving asthma. Its sphere of usefulness seems to be in the treatment of the symptoms of hay fever, vasomotor rhinitis and acute and chronic urticaria.

Barnett and his associates,[86] in a preliminary report on "benadryl" as used in the management of certain manifestations of allergy in 87 cases, including hay fever, asthma and vasomotor rhinitis, state that significant clinical improvement was observed within two or three days after the initial administration of this drug. Of 13 asthmatic patients, 6 showed definite improvement.

---

85. Wiseman, J. R., and McCarthy-Brough, M. P.: Skin Sensitivity in the Aged Totality Following Intradermal Tests, J. Allergy **16**:250-252, 1945.

86. Barnett, S. E.: Barbas, F. M., and Goss, S. B.: Benadryl in Hay Fever, Asthma and Vasomotor Rhinitis, J. Michigan M. Soc. **45**:771-776, 1946.

Barefoot, Riley and Kuhn [87] report a clinical study of "benadryl" as used in 24 cases of pruritic dermatologic complaints, including 19 cases of urticaria. Excellent results were obtained within three days after the start of the drug treatment. In only 3 cases was improvement not obtained. They found that this drug influenced toxic erythema favorably in 1 case and severe dermatitis venenata associated with angioneurotic edema in 1 case.

Notier and Roth [88] observed a patient who was given "benadryl" for hypersensitivness to cold over a period of forty-eight days. About 50 per cent improvement was noted as long as therapy was continued, but this improvement was temporary and began to decrease about two weeks after therapy was discontinued.

According to Gastineau and Leavitt,[89] "benadryl" is of value in the treatment of allergic reactions due to insulin. They administered the antihistaminic agent orally to a patient in whom localized and generalized urticaria had developed in consequence of insulin therapy. Almost complete relief of local and generalized urticaria was afforded. A dilute solution of "benadryl hydrochloride" and insulin, mixed, prevented local reactions at the site of injection. Passive transfer tests revealed the presence of reagins in the patient's serum. Direct skin tests gave evidence that "benadryl" inhibited the manifestations of insulin allergy.

"Benadryl" apparently produces no abnormal changes in the erythrocyte, leukocyte and differential counts, the hemoglobin values or the results of urinalysis. McElin and Horton [90] report on a group of 100 patients treated with the drug. They found no abnormalities in the blood or the urine even though patients were given high doses over a considerable period. They noted, however, that side reactions occurred frequently. Drowsiness was observed in 50 to 75 per cent of the patients. In some this symptom was so severe that they stopped using the drug; in others this effect diminished or gradually disappeared even with continuing use of the drug. Other side effects noted were dizziness, dry mouth, a feeling of nervousness, urinary frequency, nausea, vomiting, tinnitus and numbness or tingling in the hands or the legs.

---

87. Barefoot, S. W.; Riley, K. H., and Kuhn, B. H.: Beta Dimethylaminoethyl Benzhydryl Ether Hydrochloride (Benadryl) in the Treatment of Urticaria and Related Dermatoses, North Carolina M. J. **7**:150-152, 1946.

88. Notier, V. A., and Roth, G. M.: Treatment of Hypersensitiveness to Cold with Benadryl: Report of a Case, Proc. Staff Meet., Mayo Clin. **21**:170-175, 1946.

89. Gastineau, C. F., and Leavitt, M. D.: Treatment of Allergy to Insulin with Benadryl: Report of One Case, Proc. Staff Meet., Mayo Clin. **21**:316-319, 1946.

90. McElin, T. W., and Horton, B. T.: Clinical Observations on the Use of Benadryl: A New Antihistamine Substance, Proc. Staff Meet., Mayo Clin. **20**: 417-429, 1945.

McGavack, Elias and Boyd [91] report that "benadryl" has a depressant effect on gastric acidity when administered orally in any therapeutic range of dosage. They feel that the antihistaminic nature of the drug appears to be sufficient to warrant its being extensively tried in the management of peptic ulcer.

Sangster, Grossman and Ivy,[92] however, found that "benadryl hydrochloride" injected subcutaneously in doses of 50 mg. per kilogram does not significantly reduce gastric acidity in dogs.

Loew and Kaiser [93] state that "benadryl" has been found to be effective in alleviating histamine-induced asthma in guinea pigs. It alleviated anaphylactic shock and protected against intravenously injected histamine and the inhaled atomized solutions of histamine.

MISCELLANEOUS

Barr,[94] discussing the relationship of allergy and medicine, states that the concept of "altered reaction to bacterial and nonbacterial substances" is one of the most important ideas of medicine today. It is part and parcel of internal medicine, and no internist can be regarded as completely trained who is not thoroughly cognizant of the principles of sensitivity, anaphylaxis and the altered reaction of the body to proteins. On the other hand, no allergist can do justice to his patients or to his specialty unless he is fundamentally trained in internal medicine to the extent that he uses habitually a comprehensive history, performs routinely a complete and searching examination and is aware of related circulatory, respiratory, metabolic and psychosomatic problems. Everywhere, the practice of the science of allergy impinges on the other fields of medicine.

Black [95] makes the following statements in an article about the facts that should be known concerning allergy:

1. Allergy usually develops in early life. Only about 5 per cent of persons in whom dyspnea develops after they have reached 50 years of age are asthmatic.

---

91. McGavack, T. H.; Elias, H., and Boyd, L. J.: The Influence of Benadryl (Beta Dimethylaminoethyl-Benzhydryl Ether Hydrochloride) on Gastric Acidity, Gastroenterology **6**:439-442, 1946.

92. Sangster, W.; Grossman, M. I., and Ivy, A. C.: The Effect of Two New Histamine Antagonists (Benadryl and Compound 63) on Histamine-Stimulated Gastric Secretion in the Dog, Gastroenterology **6**:436-438, 1946.

93. Loew, E. R., and Kaiser, M. E.: Alleviation of Anaphylactic Shock in Guinea Pigs with Synthetic Benzhydryl Alkamine Ethers, Proc. Soc. Exper. Biol. & Med. **58**:235-237, 1945.

94. Barr, D. P.: The Relationship of Allergy to Medicine, J. Allergy **16**:61-68, 1945.

95. Black, J. H.: Facts That Should Be Known About Allergy, Texas State J. Med. **41**:21-24, 1945.

2. Children do not tend to outgrow their allergy. Not more than 10 per cent recovered spontaneously.
3. People usually become sensitive to things present in their diet or in their environment, not to unusual and bizarre things.
4. People frequently become sensitive to foods they like best.
5. There is an incubation period before allergy develops. For example, sulfathiazole requires nine days to sensitize.
6. Changes in weather, fatigue or infections frequently precipitate attacks.
7. Patients with pollen hay fever seldom lose the hay fever and acquire asthma. Pollen sensitivities seldom change.
8. Multiple sensitivities are the rule.
9. Sensitivities may change, but in general there is much misunderstanding about this. Infantile eczema may be succeeded by asthma, or allergic rhinitis may disappear as asthma develops, but one seldom loses a pollen sensitivity except as a result of treatment.
10. There is no utopia for allergic patients. A warm, dry climate may benefit an asthmatic person with chronic bronchitis.
11. Skin tests are only indicative, and the patient must be proved to be sensitive to that particular reacting antigen by clinical trial. Skin tests in themselves indicate only that the skin is sensitive or not sensitive to an antigen.

Cannon,[96] discussing the nutritional aspects of globulin metabolism, states that antibodies are specifically modified plasma globulin, but globulin consists of four chemically distinct fractions: fibrinogen and alpha, beta and gamma globulin. Most antibodies are found in the gamma globulin fraction. Gamma globulin contains at least six of the essential amino acids. Rat experiments indicate that a protein-depleted rat will maintain nitrogen balance if fed on a diet of gamma globulin, owing to the varied assortment of amino acids present.

If an adequate supply of the essential amino acids is absent from either the tissue protein or the daily ration during immunization, the specific antibodies will not be produced. The feeding of good quality protein tends to restore the normal ability to fabricate antibodies.

The author considers as especially important the fact that amino acid preparations may be used to maintain nitrogen balance with the patient on a nonprotein diet while one is testing for hypersensitivity to some particular food protein. Hydrolysates must be nonantigenic and complete, containing the eight essential amino acids: tryptophan,

96. Cannon, P. R.: Nutritional Aspects of Globulin Metabolism, J. Allergy **16**:78-82, 1945.

methionine, leucine, isoleucine, phenylalanine, valine, threonine and lysine.

The author tested several hydrolysates and found the enzymatic reaction to be complete. The acid hydrolysates lacked tryptophan.

In a report of the relation of respiratory allergy and unresolved pneumonia, Turnbull [97] presents 2 cases in which there was a history of allergic disturbances, coughing and sneezing, raising of purulent material, headache and aggravation of the condition by bad weather, all over a long period. When these conditions became complicated by bronchial pneumonia, resolution did not occur until an allergen-free diet, based on cutaneous tests, was prescribed. This diet brought about resolution of the pneumonic process as well as complete relief of the cough and other long-standing symptoms.

In each of these cases, after consolidation of the lung, the inflammatory, vasosecretory condition obstructed release of the pneumonic exudate, and it was not until the allergenic foods were eliminated from the diet that removal of the obstruction of the bronchioles and bronchi allowed the exudate to escape from the consolidated area.

Waldbott,[98] discussing the problems of the diagnosis of bronchial asthma, states that diseases of the lung and some extrapulmonal thoracic conditions, since they may be accompanied by wheezing and dyspnea, may camouflage bronchial asthma. Sometimes there has been failure to recognize that such disorders as cancer of the lungs, foreign bodies of the lung, syphilitic heart disease and pulmonary abscesses may occur in patients simultaneously with allergic asthma.

The author states that a few criteria may be helpful in the making of a diagnosis:

1. If the wheezing is localized in a certain pulmonic area instead of being equally distributed throughout the lung, one should always consider the possibility of a nonallergic process.
2. If rales are present in addition to asthmatic bruits, some disease other than allergic asthma, or some of its complications, should be suspected, usually pneumonitis or bronchiectasis.
3. When there is a doubt concerning the diagnosis, a most reliable feature of the patient's history is the question of whether or not nasal symptoms have been present before, or are associated with, the asthmatic condition. When this history cannot be obtained, skepticism must be used in making a diagnosis of allergic asthma.
4. The three common complications of allergic asthma are sinus disease, pneumonitis and bronchiectasis. Rare complications are

97. Turnbull, J. A.: The Relation of Respiratory Allergy to Unresolved Pneumonia, Am. J. Digest. Dis. **12**:176-178, 1945.

98. Waldbott, G. L.: Problems in the Diagnosis of Bronchial Asthma, Ann. Allergy **3**:12-30, 1945.

atelectasis of a pulmonary lobe, cystic degeneration of the lungs and multiple fracture of the ribs.

Derbes and Englehardt,[99] discussing complications of bronchial asthma, state that emphysema is one of the most common complications, while pneumothorax occurs rarely. The explanation is that the expiratory element is definitely prolonged at the expense of inspiration in bronchial asthma. The rupture occurs through the intermediary of a valve vesicle; with each inspiration more air enters the vesicle than leaves it, allowing the stretching and finally the rupture of the vesicle resulting in pneumothorax.

For patients with pneumothorax the outlook is good. The great majority of patients recover completely with no treatment. It is important that the patient rest in bed and be given sedation as needed for one month. Thoracentesis should be reserved for those cases of tension pneumothorax in which the intrapleural pressure is such as to seriously embarrass the patient's respiration.

Fuchs, Spain and Strauss[100] state that the lung tissues contain considerable cholesterol and that in the destructive diseases of the respiratory tract the sputum contains cholesterol, the amount of which is believed to be dependent on the extent of cellular autolysis.

Examination of the sputums of 51 patients suffering from bronchial asthma yielded cholesterol values which ranged from 7 to 55 mg. per hundred cubic centimeters, the amount varying with the severity of the clinical symptoms. The infectious or "skin-negative" type of bronchial asthma especially was characterized by sputum of high cholesterol value.

Turnbull,[101] in a report on allergy as a factor of surface ulcers, varicose veins, phlebitis and thrombosis, cites 6 cases. Two of the allergic patients had pruritus and eczema; 3 had varicose ulcers of the leg and 1 of the neck; 2 had angina pectoris with involvements of the coronary vessels, and there were 2 who had thrombosis of the femoral vessels.

Each of the patients received complete relief by adhering to an allergen-free diet based on cutaneous tests. It is known that allergic foods and other substances may produce inflammation and other reactions in the endothelium of the blood vessels, just as they produce sensitization of other epitheliums.

---

99. Derbes, V. J., and Englehardt, H. T.: Unusual Complications of Bronchial Asthma, J. Allergy **16**:236-244, 1945.

100. Fuchs, A. M.; Spain, W. C., and Strauss, M. B.: Sputum Cholesterol in Bronchial Asthma, J. Allergy **16**:236-244, 1945.

101. Turnbull, J. A.: Allergy as a Factor in Surface Ulcers, Varicose Veins, Phlebitis and Thrombosis, Am. J. Digest. Dis. **12**:272-276, 1945.

Zondek and Bromberg [102] state that certain pathologic disturbances arise because the organism has become sensitized to various of its hormones and the products of their metabolism. Injection of estrone or estradiol benzoate may induce general symptoms, such as nausea, vomiting, fever, diarrhea and urticaria. Administration of estrogens may give relief in some cases of pruritus vulvae only if given in low doses; large doses may cause a severe exacerbation of the disease. Certain allergic diseases, such as asthma, angioneurotic edema, urticaria and migraine, take a particularly severe form during the premenstrual phase in which follicular and corpus luteum hormones reach maximal concentrations. Cutaneous reagins to the biologic steroids (estrone, estradiol, progesterone, pregnandiol, testosterone, androsterone and desoxycorticosterone acetate) can be demonstrated by active skin tests of women suffering from certain pathologic conditions related to the menstrual cycle or to the appearance of the menopause. These reagins have properties similar to those of allergic reagins in general. Desensitization produces favorable clinical results in these patients, and this is further proof that the disturbances in question are caused by endocrine allergy.

Epstein [103] states that certain types of allergic conditions, such as angioneurotic edema, hay fever and urticaria, are commonly associated with hypothyroidism. The author cites 3 illustrative cases in which treatment of the hypothyroid state had a beneficial effect on the associated allergic conditions.

The author states that in addition to the hereditary factors which play a role in allergic conditions there may be an associated hereditary predisposition to thyroid dysfunction and that this may precede or form the basis of the allergic sensitization.

In a discussion of the coincidence of allergic disease, unexplained fatigue and lymphadenopathy and the possibility that in diagnosis this syndrome may be confused with infectious mononucleosis, Randolph and Hettig [104] state that 59 per cent of 140 student nurses were found to have a history of allergic disease. Fifty-one per cent of those having this history complained of periods of unexplained fatigue, while only 5.3 per cent of those having no history of allergy had the same complaint. This fatigue is not relieved by rest and is apt to be most marked in the morning. Unexplained fatigue, it is suggested, is a constitutional symptom of uncontrolled allergic disease.

---

102. Zondek, B., and Bromberg, Y. M.: Endocrine Allergy: I. Allergic Sensitivity to Endogenous Hormones, J. Allergy **16**:1-16, 1945.

103. Epstein, A. A.: On the Relation of the Thyroid to Allergic States, J. Mt. Sinai Hosp. **12**:191-199, 1945.

104. Randolph, T. G., and Hettig, R. A.: The Coincidence of Allergic Disease, Unexplained Fatigue and Lymphadenopathy: Possible Diagnostic Confusion with Infectious Mononucleosis, Am. J. M. Sc. **209**:306-314, 1945.

Intermittent spontaneous enlargement of the cervical lymph nodes was also seen much more frequently in those with a past history of allergic disease than in the negative controls. As a result of these enlargements, infectious mononucleosis was suspected in 31.5 per cent of those with an allergic background as against 3.6 per cent of those without a history of allergy. Clinically, there is considerable evidence that, at least in younger age groups, the lymphoid tissues participate in the allergic response.

Simon [105] reports his findings concerning the cutaneous reactions of patients with atopic eczema due to human dander. On 10 patients the author made scratch and patch tests with dander obtained from normal human scalps. These patients ranged in age from 14 to 44 years and had atopic eczema, most of them having had the eczema since infancy. Three scratches 5 mm. long and 1 to 2 mm. apart were made superficially in the skin of the back. A patch was applied immediately over the scratches and was allowed to remain in place for forty-eight hours. An eczematous reaction was noted in 9 of the 10 subjects. The lesion consisted of papules, vesicopapules, crust formation, redness and swelling. The papules were located in and immediately surrounding the scratches. Desquamation occurred within one or two weeks.

Since no positive reactions were obtained with human dander in 10 normal noneczematous controls, the author concluded that human dander is an important allergenic excitant of atopic eczema.

Pratt and Corson [106] sought to determine whether dermatitis due to poison ivy is spread by vesicle contents. Eighty-seven young men were given patch tests with an extract of poison ivy, and in 17, whose reactions were vesicular, the fluid of vesicles of the affected arm was used to make patch tests on the normal arm. The results were negative. The fluids of the vesicles of 14 other subjects were used to test their normal arms and to make patch tests on other persons who were known to be susceptible. These tests likewise caused negative reactions.

The authors concluded that the vesicle fluid of poison ivy dermatitis did not produce new lesions on the same subject or on other susceptible persons.

Grolnick, Bowman and Walzer [107] were interested in showing whether in cases of atopy sites of contact dermatitis would respond when subsequently stimulated with specific wheal-inducing atopens.

---

105. Simon, F. A.: Cutaneous Reactions of Persons with Atopic Eczema to Human Dander: Results of Patch Tests on Scarified Skin, Arch. Dermat. & Syph. **51**:402-404 (June) 1945.

106. Pratt, A. G., and Corson, E. F.: Spread of Dermatitis Venenata by Vesicle Contents, Arch. Dermat. & Syph. **51**:316 (May) 1945.

107. Grolnick, M.; Bowman, K. L., and Walzer, M.: The Response of Contact Dermatitis Cited in Atopic Individuals to Subsequent Stimulation with Specific Wheal-Inducing Atopens, J. Allergy **16**:188-191, 1945.

They state that such sites give an altered response to specific wheal-inducing atopens but that when the dermatitis reaction has completely subsided an intracutaneous test made at this site with a specific wheal-inducing atopen tends to induce formation of a wheal that is larger than one obtained at a normal site on the same subject, and the more intense the original dermatitis the more pronounced is the tendency toward increasing wheal reaction on subsequent specific excitation. The authors state that it is apparent that contact dermatitis alters the behavior of human skin in respect to subsequent whealing power.

Sutherland,[108] discussing the allergen of house dust, states that a very active fraction has been obtained from house dust by adsorption on benzoic acid. This adsorbed material, when dried, is a light brown powder which readily dissolves in water to form a 1 per cent solution. It may be purified by adding 2 cc. of acetone to form a flocculent precipitate. A saturated solution of the purified material gives no reaction for protein, but appears to consist largely of a polysaccharide.

Scratch and intracutaneous tests on dust-sensitive subjects show that the adsorbed fraction is remarkably active and that it is non-irritating when tested on normal subjects. Even a 1 : 10,000 dilution caused local reaction at first when used for therapeutic desensitization, but tolerance is rapidly established. Clinical improvement of sensitive patients is usually rapid if there are no complicating circumstances, and some patients treated in 1942 have remained almost symptom free.

The authors are attempting to complete the purification of the allergen of house dust and to study its physical, chemical and immunologic properties.

Coulson, Spies and Stevens[109] describe experiments which demonstrate the utility of the Schultz-Dale technic when one is studying the homogeneity of antigenic protein preparations. Their results emphasize that the usual precipitative methods are inadequate for the complete separation of proteins of markedly different solubilities.

Urbach and Shay[110] report a case of severe actinic dermatosis in which cure followed extirpation of an infected gallbladder. A pathologic intestinal flora was found, which may have been the cause of an increased porphyrin content of the stool. The authors suggest two mechanisms through either of which the diseased gallbladder could have been responsible for the sensitizing agent causing the hypersensitiveness to light.

---

108. Sutherland, G.: The Allergen of House Dust, M. J. Australia **1**:583-587, 1945.

109. Coulson, E. J.; Spies, J. R., and Stevens, H.: The Immunochemistry of Allergens: VII. A Study of the Homogeneity of Cottonseed-Globulin Preparations by Anaphylactic Reactions, J. Allergy **16**:176-183, 1945.

110. Urbach, E., and Shay, H.: Severe Light Hypersensitiveness Cured by Cholecystectomy, Ann. Allergy **3**:124-128, 1945.

In a discussion of allergy caused by tobacco smoke, Pipes [111] states the records of 370 consecutive allergic patients seen in private practice were studied. Nine to 10 per cent gave a history definitely indicating that their respiratory allergy was precipitated or aggravated by exposure to tobacco smoke. Thirteen per cent gave positive cutaneous reaction to an extract of tobacco smoke. Passive transfer sites of injection of tobacco-sensitized serum could be exhausted with an extract of tobacco but could be reduced only approximately 40 to 50 per cent with the extract of tobacco smoke. This seems to indicate that allergy due to tobacco smoke may be a distinct entity, exclusive of allergy to tobacco, and hyposensitization should be carried out with tobacco smoke extract alone.

Blank [112] reports a case of sensitivity due to oral administration of castor oil. The patient was a white soldier, aged 23. Within twenty minutes after taking the drug he began having generalized abdominal cramps and diarrhea. Within two hours his tongue and fauces were reddened and slightly edematous. A scarlatiniform rash developed, with slight fever and a fast pulse. The patient recovered in four days, and after a three day rest 4 cc. of castor oil was given orally. Immediately the aforementioned symptoms again were precipitated. It is thought to be the first case of castor oil sensitivity reported.

Blumstein [113] studied 406 patients sensitive to molds, by means of skin tests. All the patients whose skin reacted to the mold extracts were tested by the nasal route with the corresponding mold powder. One hundred and sixty-nine of the patients displayed positive skin reactions to one or more mold extracts, an incidence of 41 per cent, while only 12 patients, 3 per cent, displayed clinical sensitivity. All the evidences of mold allergy occurred in patients with seasonal symptoms. Of the 12 clinically sensitive patients, 10 presented symptoms of asthma, while the remaining 2 complained only of seasonal rhinitis.

The molds which were of etiologic significance in this group were in order of importance: Alternaria, Hormodendrum, Monilia, Helminthosporium, Cephalosporium and Mucor. The author suggested that extracts of these molds be used for skin tests of patients suspected of being sensitive to molds and that mold allergy may serve to explain partly the origin of many seasonal cases of hay fever and asthma that were previously considered to be cases of pollinosis with negative cutaneous and clinical tests.

---

111. Pipes, D. M.: Allergy to Tobacco Smoke, Ann. Allergy **3**:277-282, 1945.

112. Blank, P.: Sensitivity to the Oral Administration of Castor Oil, Ann. Allergy **3**:297, 1945.

113. Blumstein, G. I.: Mold Allergy: II. Clinical Analysis, Ann. Allergy **3**:341-347, 1945.

Abstracts from Current Literature

Ear

CRITICAL REVIEW OF THE LITERATURE ON THE VALIDITY AND RELIABILITY OF AUDIOMETRIC TESTING. JAMES CARRELL and GENEVA JEFFERS GORMLEY, Speech Monogr. **13**:66, 1946.

Pure tone threshold values are probably fairly accurate today so far as air conduction is concerned. Measurements of bone conduction of pure tones have been strongly criticized. It is at least questionable whether the ability to hear speech can be predicted from the audiogram. "Recruitment of loudness" refers to a phenomenon which may be described as follows: After sound reaches a certain point above the threshold, it may be sensed with almost equal loudness in the diseased and the normal ear. It is important to take the recruitment factor into consideration in fitting hearing aids in cases in which there is involvement of the auditory nerve. Soundproof rooms are essential for audiometry. Under no other conditions are the tests reliable. Almost no literature on the technic of audiometry is available. Careful studies of the effects of certain variables in the testing technic are needed. Information is still lacking on both the validity and the reliability of bone conduction measurements, and more research is needed on the recruitment factor.

PALMER, Wichita, Kan.

STENOSIS OF THE EUSTACHIAN TUBE. H. A. E. VAN DISHOECK, Nederl. tijdschr. v. geneesk. **88**:247 (March 11-18) 1944.

By means of the pneumophone, an apparatus indicating by what pressure on the drum hearing is improved, the author investigated (*a*) the physiologic stenosis of the tubes, (*b*) acute stenosis and (*c*) chronic stenosis. He concludes from his studies that the eustachian tube, as far as the localization of its inflammation is concerned, must be divided into a nasal and a tympanal part, which parts, as regards their diseases, are closely connected with the pharynx and the middle ear. Further, chronic stenosis of the tube is of the utmost importance in the morbid picture. By means of the pneumophone the syndrome of the catarrhal stenosis of the tube can be diagnosed, as well as the stenosis of the tube without signs of inflammation.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

Pharynx

BISMUTH SALICYLATE IN OIL: THE TREATMENT OF CHOICE IN VINCENT'S ANGINA. HARRY D. GROSSMAN, Illinois M. J. **89**:28 (Jan.) 1946.

Of 150 patients treated with bismuth subsalicylate in oil, given intramuscularly 10 per cent required three injections before the lesions disappeared completely; the others all had two injections forty-eight to seventy-two hours apart. The patient is usually much relieved within twenty-four hours after the first injection. The first dose is 1.5 cc. (2 grains). The second and subsequent doses are 2 cc. (4 grains) each. The injections are made deep in alternate buttocks.

BARBOUR, Peoria, Ill. [AM. J. DIS. CHILD.]

Miscellaneous

INTELLIGIBILITY MEASUREMENT. C. HESS HAAGEN, Speech Monogr. **13**:4, 1946.

During the war, measurements of the intelligibility of vocal communications were made at the voice communication laboratory of the Army airfield at Waco, Texas. At any one time from 8 to 12 students were stationed on a party line network over which they could talk and listen to one another through airplane intercommunication equipment. High level, airplane type noise filled the testing room. Each student read a list of words in the manner, "Number one is fog. Number two is dashboard," and the remaining persons on the line wrote what they heard the test words to be. The introductory phrase tended to make the reading of the words sufficiently slow for the listeners. The speaker's intelligibility score was the proportion of correct responses made by all the listeners. Four such party lines or circuits operated in the same room simultaneously. Final tests were drawn from 5,000 words used in trials, selected on the basis of one syllable and two syllable words, words with Thorndike ratings of 10 or less, words that were pronounced correctly at least 90 per cent of the time, etc. Experimental work was conducted mainly with 24 item word lists, of which forty-eight equivalent forms were constructed. Later these items were refined and regrouped into twenty-four 12 word lists. Minimum standardization for all tests was based on 50 speakers with 450 listeners. Speakers and listeners were rotated throughout the speaker-listener panel. These tests served to measure the average effectiveness of microphone positions, voice variables and training technics. The standardization of these tests provides the largest number of speaker-listener responses for individual words that has occurred. The scope of study verified indications that for a single condition the relative intelligibility of words is markedly stable from person to person and, for one person, from time to time.

PALMER, Wichita, Kan.

INTELLIGIBILITY RELATED TO MICROPHONE POSITION. JAMES F. CURTIS, Speech Monogr. **13**:8, 1946.

During World War II the American Air Forces used in general three classes of microphones—all carbons: a hand-held microphone, a throat microphone and a special type for inserting into oxygen masks. This investigation concerned only the hand-held and throat types. Cadets who were in their first four weeks of basic pilot training served as speakers and listeners in this study. The microphone was tested in zero distance from the lips, ½ inch distance, 1 inch (2.5 cm.) distance, 30 degrees away from the speaker's mouth with the closer edge just close enough to touch the speaker's lips, 45 degrees away from the speaker's face, and the encircling position, in which the speaker attempts to shield the microphone by encircling the rim of the microphone with his thumb. No restrictions were placed on speakers relative to loudness. Intelligibility scores, average speech signal intensities, and speech to noise ratios all decrease as the distance of the microphone from the speaker's lips is increased. Zero distance and thumb-encircling positions gave approximately equal intelligibility. Those speaking from the zero distance position made higher average intelligibility scores. Finally, the throat microphone was investigated relative to the best position. A center position was achieved by placing the microphone as nearly as possible at the level of the prominence of the larynx. For the low position the experimenter placed his finger across the front of the subject's larynx at a point corresponding to the center position and adjusted the microphone into position below and touching the finger. The high position was the same except that the microphone was placed above and touching the finger. The low position is definitely inferior.

PALMER, Wichita, Kan.

INTELLIGIBILITY RELATED TO LOUDNESS. PAUL MOORE, Speech Monogr. **13**:13, 1946.

At the beginning of the war the training manuals of the Army Air Forces suggested using over the interphone a conversational voice or the normal or customary manner of speaking. This study was set up to answer the following questions: (1) When talking from one position to another in a bomber, how loudly should one speak when using (*a*) a hand-held microphone, (*b*) a throat microphone, (*c*) an oxygen mask with an insert type microphone? (2) Do the results differ with the type of head set used by the listener? (3) How do the several kinds of ear phone cushions influence intelligibility? (4) Is the optimum loudness for messages spoken over the interphone also best for messages sent by the several most common radios? In all of the experiments loudness was definitely correlated with intelligibility except on shouting, and the most optimum level of intelligibility was the level just under shouting.

PALMER, Wichita, Kan.

THE EFFECT OF VERY LOUD SPEECH SIGNALS UPON INTELLIGIBILITY. HARRY M. MASON, Speech Monogr. **13**:19, 1946.

Experiments with noise-shielded microphones and with ear plugs indicate that for the signal to noise ratios used, relatively weak signals are more intelligible than very strong ones. Proof that these effects are not due to peculiarities of equipment is offered in an experiment in which frequency response and signal to noise ratio were held constant, but intensity of stimulation was varied. In this experiment, weak signals were more intelligible than strong ones. The applicability of the instruction to speak loudly is, at least to some degree, dependent on the type of equipment used. In the American Air Forces most speakers use microphones which do not produce highly favorable signal to noise ratios unless voice levels are high.

PALMER, Wichita, Kan.

INTELLIGIBILITY RELATED TO PITCH. I. P. BRACKETT, Speech Monogr. **13**:24, 1946.

Two methods were used to determine pitch level, judgmental and physical. For the first, five pitch levels were recorded and compared with similar portions of recorded intelligibility tests. For the physical determination, portions of the speakers' voices were transcribed on transparent disks, and the sound wave impressions were magnified and counted. Forty subjects using hand-held microphones read intelligibility tests at each of four pitch levels: uninstructed, higher, very high and low. No improvement of intelligibility resulted. Instruction in change of pitch produced small changes in the pitch of speaking. Since the speakers spoke in a noisy situation, an experiment was run showing that speakers tend to raise the pitch of the voice when speaking loudly in a noisy situation. A description of the equipment used for physical analysis is included.

PALMER, Wichita, Kan.

STUDY OF PHONETIC FACTORS IN RELATION TO ACCURACY OF TRANSMISSION OF WORDS IN AIRPLANE NOISE. WILMER E. STEVENS, Speech Monogr. **13**:32, 1946.

A statistical study of the phonetic characteristics as related to intelligibility of 898 common one syllable and two syllable words used in testing United States Army Air Forces personnel and a follow-up investigation of the relative capacities of speech sounds to preserve their identity in words incorrectly transmitted were carried out at a voice communication laboratory. Words of two syllables were found to be more intelligible than words of one syllable. Some evidence was found

of a significant relationship between intelligibility and the patterns of stress of words of two syllables. One class of speech sounds, the fricatives in the words "sit," "fox" and "think," was found to be consistently associated with low intelligibility. The class of sounds found to be most significantly associated with high intelligibility (in two syllable words only) was that, including the diphthongs, in the words "tone," "cow," "boy," "high" and "tape." In two syllable words, also, the sounds included in "risk," "watt," "which," "how" and "year" were found to be associated with better than average intelligibility. Words the articulation of which involves protrusion and recession of the lips were found to be reliably superior to others in intelligibility. Vowels, including diphthongs, were found to preserve identity more often than consonants. For vowels a significant variation in value associated with manner of enunciation was found to exist. The values were found to range from 0.22 to 82 per cent for consonants occurring before the vowel and from 0.20 to 82 per cent for consonants occurring after the vowel. The values for certain consonants were found to shift significantly according to position relative to the vowel. A description of the methods by which these various studies and results were obtained is included.

PALMER, Wichita, Kan.

IMPROVEMENT OF LISTENER PERFORMANCE IN NOISE. HARRY M. MASON, Speech Monogr. **13**:41, 1946.

Training of listening was given to improve intelligibility of communication in noisy situations. For this purpose, 155 cadets (unassigned) of the American Air Forces took a recorded intelligibility test, were trained in listening, and retested, the same test being used before and after training. To subgroups different kinds of training were given, each emphasizing one aspect of listening experience. Controls consisted of general listening training and three hours of training in airplane type noise. The "familiar speakers training" received by this group was the same as that given the preceding group except that the monitors who gave listening training were 4 of 8 speakers who recorded the listening test; "familiar words training" in this group was the same as in the general listening group except that the training exercises contained one half of the words of the test used before and after training. Increased listening ability was evident in all groups. Listening training alone was relatively ineffective. The experiment did show, however, that the factor of being familiar with a special vocabulary may be an important one in efficiency of communication.

PALMER, Wichita, Kan.